NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY

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STOPPING RULES FOR AUDIOLOGICAL ASCENDING TEST PROCEDURES:

Computer Simulation Evaluation

by

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and
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Naval Medical Research and Development Command
Research Work Unit M0100.001-1021

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SUMMARY PAGE

PROBLEM

To use Monte Carlo simulations to examine the efficiency of various stopping rules for audiological threshold test procedures.

FINDINGS

Thresholds were located at higher percents correct for steeper psychometric functions. Stopping rules requiring two responses at one level were faster than those requiring three responses with only a small decrease in consistency. Among stopping rules using the same number of responses for criterion, differences were seen primarily in efficiency at shallow slopes, particularly for procedures using a three-response rather than a two-response criterion. The most efficient rule uses the first N responses at a level, with no requirement about whether the responses were present on half or a majority of the ascents, no consideration of the total number of ascents, and no update rule.

APPLICATION

Audiological procedures using a two-response criterion are preferable to those using a three-response criterion. While the reliability of these procedures is probably adequate for clinical estimates of threshold, it is inadequate for sonar laboratory research, unless modifications can improve the reliability.

ADMINISTRATIVE INFORMATION

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ABSTRACT

Stopping rules for ascending audiological test procedures were evaluated by Monte Carlo Simulation. The stopping rules differed in the minimum number of correct responses required at a level, whether these responses occurred on half or a majority of the ascents, and whether all or only the most recent ascents were considered. Simulated threshold values ranged from -12 to 92 dB SPL in steps of 1 dB. Slopes of the psychometric functions ranged from 0.1 to 1.0 in steps of 0.1. For each procedure, 200 threshold determinations were simulated for each combination of slope and threshold value.

For all procedures, shallow slopes resulted in thresholds closer to the level giving 50% detection than did higher slopes, which were roughly 2.5 dB above 50% on the psychometric function. Shallow slopes also resulted in decreased consistency across threshold measurements, an increased number of trials required for threshold estimates, and a higher proportion of estimates that had to be repeated to obtain threshold. Stopping rules using a two-response criterion were faster than those using a three-response criterion, with only a small decrease in consistency. Among stopping rules using the same number of responses for criterion, differences were seen primarily in efficiency at shallow slopes, particularly for procedures using a three-response rather than a two-response criterion for stopping.

INTRODUCTION

Efficient methods are needed to determine thresholds in laboratory settings for sonar tasks. For signal-processing research, it often is important to use many different signals and conditions, necessitating the collection of many thresholds during an experiment. However, sonar technicians typically are not available for long periods of time, unlike the situation in university laboratories where groups of subjects can be scheduled for two hours per day for an entire semester. Audiological test procedures represent a potential method for collecting these data because they have been designed for rapid estimations of thresholds on large numbers of untrained listeners.

Audiological test procedures present auditory stimuli in ascending intensity steps until a response occurs, whereupon the intensity is decreased and a new ascending series is begun. Each stimulus presentation occurs for a discrete amount of time during an unmarked observation interval, and the listener responds whenever the stimulus is detected (i.e., free response). For estimates of at-sea sonar performance, audiological procedures appear to have greater face validity than do other laboratory testing procedures. For example, most laboratory procedures are designed to have defined times where the signal can occur. Audiological procedures do not have a defined observation interval as is also the case for sonar where a signal can occur at any time. Furthermore, by employing "free-responses," audiological procedures let the listener establish a criterion for the detection of the signal. Thus, response proclivities influence thresholds, as they do for sonar tasks. Typical laboratory procedures, such as an adaptive two-interval forced-choice (2IFC) procedure, minimize attentional and bias effects, which is highly desirable if the purpose of the test is to answer questions about the capabilities of the ear. However, these laboratory procedures can be expected to give lower thresholds than procedures that allow response proclivities to affect the measurement. For example, for pure tones in quiet, thresholds for an adaptive 2IFC procedure estimating 70.7% correct are about 6.5 dB lower than those obtained for audiological procedures (Marshall and Jesteadt, 1986).

A potentially limiting factor for audiological procedures is that clinical applications can tolerate poorer test-retest reliability than can research applications, particularly when small numbers of subjects are used. Thus, it is necessary to examine the efficiency of these methods. In this paper we use computer simulation and a model of human performance to examine the hypothetical efficiency of several audiological procedures. Computer simulations allow us to quickly estimate the effect of changing various parameters of the procedure, without having to recruit and test large numbers of subjects over long periods of time. For example, for this study, we simulated the hypothetical performance of 1,050 subjects, each of which had 2,800 threshold estimates. Computer simulations also are useful in comparing

actual and theoretical performance so that the inherent limitations that are due to the procedures themselves can be recognized. For example, it is useful to know what aspects of a test determine its reliability and what changes can be made to increase the reliability. Also, we can evaluate our understanding of human performance by comparing results for actual and simulated tests. If they are the same, then we can substitute simulations of human performance for testing of actual subjects. For example, in the sonar equation, it would be helpful to be able to better predict the human performance part of the equation. If they are not the same, then we need to better understand human performance so that we can model it accurately.

Hughson and Westlake (1944) recommended that uniform procedures be used for clinical hearing tests, and proposed a standard procedure for obtaining threshold measures on naive listeners. Since then, a number of interpretations and variations of their method have been used in audiological settings. Most of them have retained one central feature of the Hughson and Westlake procedure - thresholds are estimated by a series of trials at successively higher levels until a subject response is obtained, at which point the stimulus level is decreased and another ascending series is begun. The various procedures differ in a number of ways, but one of the most obvious ways is the "stopping rule," which determines when a threshold track is terminated. In this paper we evaluate several of the stopping rules by the method of Monte Carlo simulation.

The procedure we use is a standard audiological test procedure, differing only in the stopping rule for termination of the test. Audiological procedures can be described as consisting of two phases, a familiarization phase, which serves to present the subject with a clearly audible signal, and a subsequent test phase. For the purposes of the present study, we adopt a standardized familiarization technique and then examine the differences due to different stopping rules during the test phase.

The stopping rules we examine are those suggested by Hughson and Westlake (1944), Carhart and Jerger (1959), ASHA (1978), ANSI (1978), and ISO (1986), as well as other rules that can be generated using combinations of the features of these rules. The basic questions that define the distinguishing features of these stopping rules are: 1) What is the minimum number of responses required at the same level (i.e., two or three); 2) is it required that these responses represent half or a majority (i.e., more than half) of the number of relevant ascending series; and 3) are the relevant ascending series: a) all ascending series subsequent to familiarization (e.g., Hughson and Westlake or Carhart and Jerger), b) some predefined number of ascending series after which the test is repeated if the criteria for stopping are not met (e.g., ISO), or c) some number of previous ascending series, such that only the most recent ascents are considered (e.g., ANSI)? A factorial combination of these three basic characteristics produces twelve possible stopping rules, which are listed in Table

I. In addition, two other stopping rules are listed based on the Carhart and Jerger implication that it is sufficient to terminate a track when three responses are obtained at a level, regardless of the number of ascending series.

METHOD

Computer simulations were performed for each of the stopping rules shown in Table I. The columns of the table refer to whether there is a limit on the number of ascents and whether an update is used. "NO" has no limit on the number of ascents used for threshold measurements, and does not use an update rule (i.e., uses all the responses, not just the most recent ones). "MAX" has a maximum number of ascents, and it also does not use an update rule. "UP" uses an update rule, and has no limit on the number of ascents. The rows refer to the mimimum proportion of responses that must be present at the threshold level. "M", the majority rule, requires that responses occur at a single level on the majority of ascents. "H", the half rule, requires that responses occur at a single level on at least half of the ascents. "A", absence of "percent rule," relies entirely on the absolute number of responses at a particular level, without regard for whether or not these responses occur on a specified proportion of the ascents. Nested within the table is whether two or three responses are required at a level. Each cell of the table contains the stopping rule that results from combining these parameters. Four of the cells are blank because whenever there is a maximum or an update rule, there is an implicit percent rule.

In order to evaluate the effects of stopping rules independently from other variations in procedures, all characteristics of the familiarization procedure were held constant across all comparisons, as were all characteristics of the test phase, other than the stopping rule. The familiarization technique used was similar to those suggested by Hughson and Westlake (1944), Carhart and Jerger (1959), the AHSA (1978) guideline, and the ANSI (1978) standard. The first presentation was at 30 dB HL. If a response was obtained, the signal was decreased in 10-dB steps until no response was obtained, then the test phase was begun. If no response was obtained to the first presentation, the signal was presented at 50 dB HL and the level successively increased in 10-dB steps until a response was obtained. Then, the signal was decreased in 10-dB steps until no response was obtained, at which point the test phase was begun. During the test phase, the level was decreased 10 dB following a response and increased 5 dB if there was no response. Following the wording used in the ASHA (1978) guideline and ANSI (1978) standard, the 10 dB decrement always resulted in the beginning of a new ascending series; thus, all responses during the test phase were included in threshold determinations. Threshold was estimated as the level of the last presentation during the test phase.

Underlying psychometric functions relating percent correct responses to stimulus level were assumed to be linear in z-score

TABLE I.

Combinations of parameters used to generate fourteen stopping rules.

RESPONSES		NO (No limit on number of ascents; no update)	MAX (Limit on number of ascents; no update)	UP (No limit on number of ascents; update)
M (Majority)	2	Two congruent; majority rule	Two congruent; three ascent limit	Two congruent of last three
	3	Three congruent; majority rule	Three congruent; five ascent limit	Three congruent of last five
H (Half)	2	Two congruent; half rule	Two congruent; four ascent limit	Two congruent of last four
	3	Three congruent; half rule	Three congruent; six ascent limit	Three congruent of last six
A (Absence of percent rule)	2	Two congruent	-	-
	3	Three congruent	-	-

The table's heading "ASCENTS AND UPDATES" spans the NO, MAX and UP columns.

units as a function of signal level in dB. Slopes of the psychometric functions ranged from 0.1 to 1.0 in steps of 0.1 (based on the range of psychometric functions found by Marshall and Jesteadt, 1986, using actual listeners). Threshold values, i.e., stimulus levels corresponding to 50% correct, ranged from -12 to 92 dB HL in steps of 1 dB. No upper or lower boundary limits were placed on level, unlike those imposed by audiometer limits. For each procedure, 200 threshold determinations were simulated for each combination of slope and threshold value. Each threshold determination began with the familiarization procedure. The first stimulus in the first ascent of the test phase was 5 dB greater than the last stimulus of the familiarization procedure. The test was continued until the requirements for the selected stopping rule were met. Although some procedures are described as having no limit to the number of ascents, it was impractical to adhere strictly to this rule because some runs of some procedures could continue indefinitely. If the stopping rule was not met within 12 ascents, the measurement was begun again at the first level of the test procedure.

Each simulated threshold measurement produced: 1) an estimated threshold in dB relative to the "true" 50% detection value on the psychometric function, 2) the number of trials required to estimate the threshold (including familiarization trials and all repeats), 3) the number of ascents during the test phase (for the last repetition of the test phase if it was repeated), and 4) an indication of whether the test procedure had to be repeated to estimate a threshold.

RESULTS AND DISCUSSION

Data were collapsed into groups of five adjacent threshold values, e.g., the results obtained for threshold values of 8, 9, 10, 11, and 12 dB were combined and reported as 10 dB. Several summary statistics were computed: 1) average estimated threshold in dB (relative to the true 50% detection value), 2) average standard deviation within levels (obtained by calculating the standard deviation of the 200 threshold estimates at each level, then averaging the standard deviations across five adjacent levels), 3) standard deviation across levels (obtained by calculating the standard deviation of the 1000 threshold estimates within a group of five adjacent levels), 4) average number of trials to arrive at a threshold estimate, and 5) the proportion of threshold determinations that had to be repeated one or more times. Tables with these summary statistics for all combinations of stopping rules are contained in the appendices. In the following sections, we first discuss the similarities and differences among stopping rules requiring at least three responses at a level. Next, we compare stopping rules using a two-response criterion with those using a three-response criterion.

A. Stopping Rules Requiring at least Three Responses at a Level

1. Similarities among stopping rules

Several general comments can be made which apply to all the stopping rules requiring at least three responses at a level. The estimated threshold, standard deviation within levels, and standard deviation across levels are affected by the slope of the psychometric function, but not by the stopping rule itself. In addition, the slope of the psychometric function influences the number of trials in the same way for all stopping rules, even though the absolute number of trials differs across stopping rules. Finally, for all stopping rules, hearing level has little effect on any of the measures except for number of trials.

a. Threshold estimate

There were no observed differences in threshold values among all the stopping rules. For all but the shallowest slopes (0.1 and 0.2), the stopping rules yield estimated threshold values about 2.5 dB greater than the level on the psychometric function corresponding to 50% correct. Figure 1 (left panel) illustrates the location of estimated threshold relative to the 50% point as a function of slope for two typical stopping rules (chosen as representative of the range on another statistical measure, number of trials, discussed later). These threshold estimates mean that the procedures are not estimating the 50% point, but some value above the 50% point. Because this finding is essentially independent of slope (except for very low slopes), the procedures are estimating points on the psychometric functions which differ in terms of percent correct. Threshold values corresponding to higher percents correct are estimated for steeper slopes. Marshall and Jesteadt (1986) obtained audiological thresholds and underlying psychometric functions at two frequencies for four groups of listeners varying in age and hearing levels. Using their data for 70 listeners, rank order correlations between slope and location of estimated threshold on its underlying psychometric function ranged from 0.20 to 0.74 across conditions and groups of subjects, with a mean correlation of 0.46. These results confirm that higher slopes tend to produce thresholds located at higher points along the psychometric function, at least for this step size. At lower slopes, the thresholds are located closer to the 50% point. A smaller step size used with higher slopes should produce the same effect; i.e., estimated thresholds closer to the 50% point.

b. Standard deviation within levels

The standard deviation within levels (standard deviation of the 200 threshold estimates at a level, averaged across the five levels within a bin) is a measure of the repeatability of the threshold estimate. There was no observed difference in standard

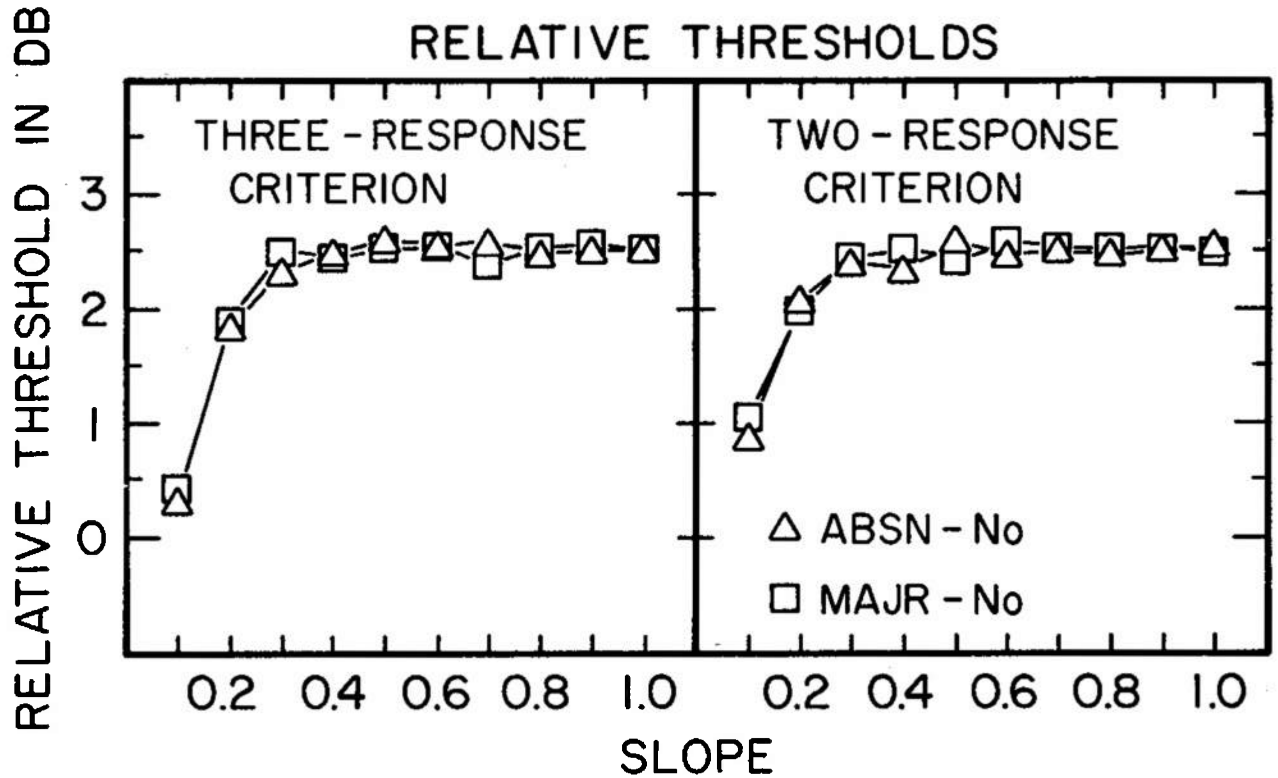

Figure 1. Thresholds relative to the 50% level on the psychometric function as a function of slope for two stopping rules (A-NO and M-NO) at 25 dB HL. A three-response criterion is shown in the left panel and a two-response criterion is shown in the right panel.

deviation within levels among all the stopping rules. For all stopping rules, the repeatability of the threshold estimate is better with steeper slopes. The standard deviation within levels for all stopping rules is around 0.8 dB for slopes of 1.0 and increases to around 4.5 dB for slopes of 0.1. Figure 2 (left panel) illustrates this effect for a typical procedure (A-NO). The reason for this slope effect, which is discussed in more detail in section A.1.d., is that the combination of steep slopes and a large (5 dB) step size results in signals that tend either to be clearly heard or else not heard at all.

c. Standard deviation across levels

The standard deviation across levels (standard deviation of the 1000 threshold estimates in a five-level bin) reflects the consistency of the threshold estimates across levels. It is equal to the repeatability measure if the five relative threshold levels within each bin are alike and is larger than the repeatability measure if the thresholds for the five levels within each bin are at different locations on the psychometric function. There were no observed differences in standard deviations across levels among all the stopping rules. As shown in Figure 2a, repeatability and consistency are equivalent at low slopes, but diverge at high slopes. For steep slopes, the large step size causes the thresholds within each bin to be located at different points on the psychometric function. The relative thresholds (in dB relative to the 50% point on the psychometric function) are the same for each 10 dB increment in hearing level, but each relative threshold within the 10 dB span is different. For example, for one procedure at a slope of 1.0, the relative thresholds were 2.8, 3.9, 1.1, 2.0 dB for hearing levels of 10, 11, 14, and 18 dB, and were 3.0, 3.9, 1.1, and 2.0 dB at hearing levels of 20, 21, 24, and 28 dB. This "scalloping" effect was seen systematically across all hearing levels. A smaller step size should improve the standard deviation across levels for high slopes.

d. Effect of simulated slopes and "true" threshold values on number of trials

The stopping rules differed in absolute number of trials (discussed in the following section). However, the effects of simulated slopes and true threshold values on number of trials (speed of estimate) are similar for all these stopping rules.

The speed of estimate (as indicated by number of trials) is quicker with steeper slopes. From 1-1/2 to 5-1/2 times more trials are required for slopes of 0.1 as compared to 1.0, with slower procedures showing the largest differences. Figure 3 (left panel) shows the number of trials required for one simulated threshold, 25 dB HL. Considerations discussed by Carhart and Jerger (1959) can explain both the decrease in the number of trials and the improvement in repeatability of the threshold estimate (section A.1.b. above) at high slopes. With steep

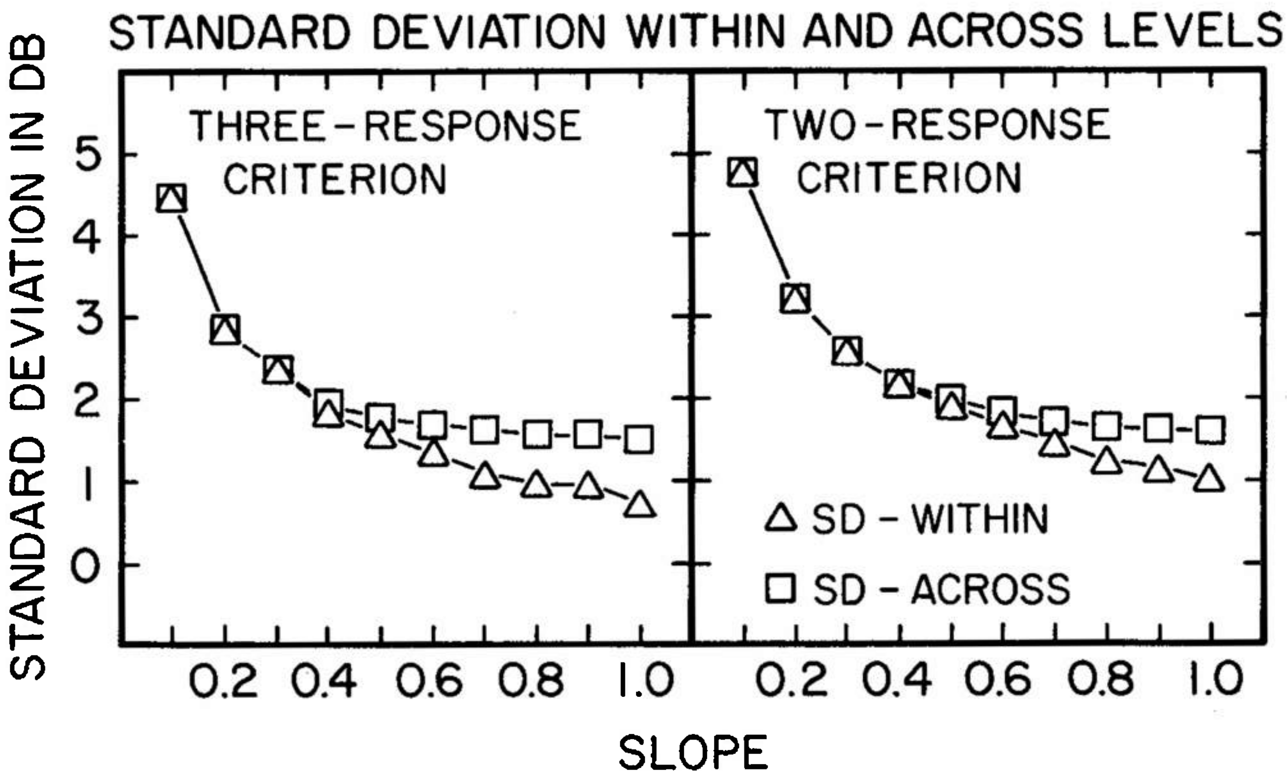

Figure 2. Standard deviation within and across levels as a function of slope for one procedure (A-NO) at 25 dB HL. A three-response criterion is shown in the left panel and a two-response criterion is shown in the right panel.

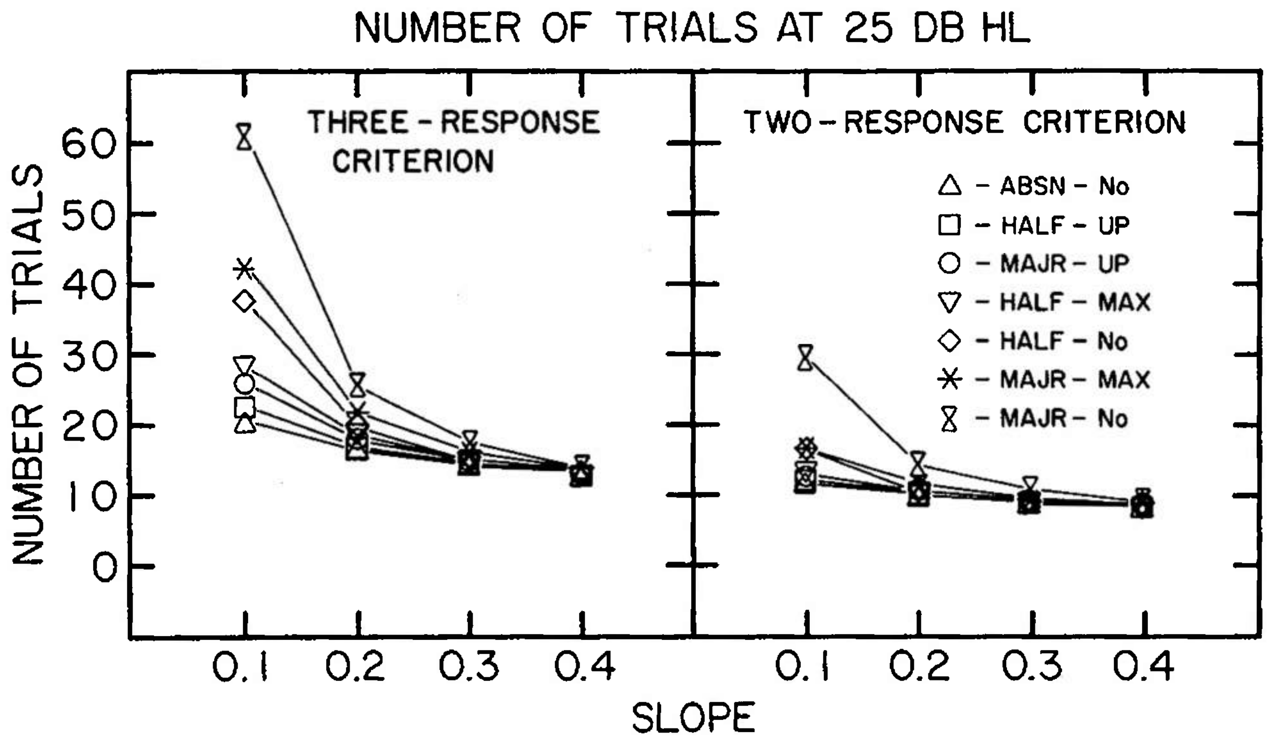

Figure 3. Number of trials at 25 dB HL as a function of slope for all procedures. Stopping rules with a three-response criterion are shown in the left panel. Those with a two-response criterion are shown in the right panel.

slopes, the signal is rarely presented at levels where there is any ambiguity of response; i.e., it is either detected consistently or missed consistently. The consistency of individual responses yields reproducible estimates of threshold as well as rapid threshold determinations, which depend on consistency within a threshold determination for stopping the test. These considerations motivated the choice of a 5-dB step size for the ascending procedure (Carhart and Jerger, 1959), because 5 dB was thought to be large relative to the "moment-to-moment fluctuations in auditory sensitivity." Although this step size is large considering slopes for the majority of audiological test subjects, for some subjects and tasks, an even larger step size is required. Thus, that some audiological subjects are labeled 'untestable' by current procedures may simply reflect the failure of the procedure to converge for a subject with a shallow psychometric function; a step size of 10 dB may avoid the problem for these subjects.

For all stopping rules, the minimum number of trials occurs for true threshold values in the 10 to 25 dB range (Figure 4). A 1 trial increase per 10 dB in threshold value occurs for thresholds above 50 dB and below 10 dB. These results are due to the 30 dB starting level and the 10-dB step size in the familiarization phase. Carhart and Jerger (1959) suggested starting levels of 30 dB SL for manual pure-tone testing, which would be more efficient than 30 dB HL. An even more efficient starting level would be 20 dB SL. For automated procedures, efficiency might be improved either by setting starting levels based on thresholds obtained in relation to predicted audiogram (e.g., older or noise-exposed individuals often have high-frequency losses, so at higher frequencies each starting level might be 30 dB above the threshold of the lower adjacent frequency), or by developing a more efficient rule to find initial levels for each threshold measurement.

2. Differences among stopping rules

The stopping rules differ in terms of their speed (average number of trials required to complete the threshold estimate) and the proportion of threshold runs that must be repeated in order to complete a threshold estimate. These differences are seen only for lower slopes. At higher slopes, all the procedures are similar.

a. number of trials

Differences in speed across stopping rules occurred primarily for slopes less than 0.4 (left panel of Figure 3). For slopes of 0.1, 0.2, 0.3, and 0.4, the difference between the fastest and slowest procedures, in average number of trials (across all hearing levels) was roughly 45, 10, 3, and 1 trials, respectively. The rank order of the stopping rules (from fastest to slowest) is:

1) A-NO-3 ----First three responses at a single level, i.e., absence of a percent rule, no limit on number of ascents, and no update.

2) H-UP-3 ----Three responses at a single level out of last six ascents (half rule with updates), no limit on number of ascents.

3) M-UP-3 ---Three responses at a single level out of last five ascents (majority rule with updates), no limit on number of ascents.

4) H-MAX-3 ---Three responses at a single level with six-ascent limit (half rule with limit on the number of ascents), no update.

5) H-NO-3 ---Three responses at a single level with half rule, no limit on number of ascents, no update.

6) M-MAX-3 ---Three responses at a single level with five-ascent limit (majority rule with limit on the number of ascents), no update.

7) M-NO-3 ---Three responses at a single level with majority rule, no limit on number of ascents, no update.

To maximize efficiency, a half or majority rule is a poor choice. A half rule is better than a majority rule, however, and either should include an update rule. If an update rule is not included, it is better to set a limit on the number of trials than to keep going with no limit (or, as in our case, using a large number of ascents to end the series). The most efficient rule uses the first three responses at a level, with no requirement about whether the responses were present on half or a majority of the ascents, no consideration of the total number of ascents, and no update rule.

b. repetitions

The stopping rules also differed in the proportion of threshold runs that had to be repeated in order to obtain a threshold estimate. The fastest procedures, A-NO, H-UP, and M-UP, never had to be repeated. The other procedures often could not obtain a threshold estimate within 12 ascents (equivalent to 12 positive responses), particularly for lower slopes. Of the four procedures that had this problem, H-NO had the fewest number of repeats, followed sequentially by H-MAX, M-NO, and M-MAX (upper two panels of Figure 5). The majority and half rules, unless combined with an update rule, are inefficient. They result in a high number of unsuccessful attempts to estimate threshold and must therefore be frequently repeated, which makes them slow.

3. Comparison among the better stopping rules

Because the stopping rules are essentially equivalent for slopes greater than 0.4, comparisons among any of the stopping rules are important only at lower slopes. As stated earlier, there are no differences in estimated thresholds among stopping rules, and neither the standard deviation within levels nor the standard deviation across levels was ever more than 10% higher for the faster procedures compared to the slower ones. Because the estimated thresholds and standard deviations were essentially the same for all stopping rules, the faster procedures are the ones of choice. The top three stopping rules, A-NO-3, H-UP-3, and M-UP-3, never required repeats to obtain a threshold estimate, which results in their being the most efficient procedures. Differences among these three stopping rules occurred primarily for slopes of 0.1. The top contender is A-NO-3, which does not use a majority or half rule. The second and third choices are H-UP-3 (half rule) and M-UP-3 (majority rule), both of which use update rules. M-UP-3 required roughly 5 more trials at a 0.1 slope and 1 more trial at a 0.2 slope than did the fastest procedure (A-NO-3). H-UP-3 differed from the fastest procedure by roughly one trial at a slope of 0.1. Thus, the differences in number of trials among these three stopping rules is, on the average, quite small. However, the standard deviation of the number of trials (a statistic also included in the appendix) differed among the three stopping rules for slopes below 0.5 (the standard deviations for H-UP-3 and M-UP-3 were two and three times, respectively, as large as those for A-NO-3 at a 0.1 slope). Therefore, although differences among the best three stopping rules are mimimal, the slower procedures are more variable in number of trials for low slopes, and thus will sometimes result in a large number of trials to estimate threshold. Because the differences in average number of trials is small, however, the differences among standard deviations probably are inconsequential.

B. Comparison of Two- and Three-Response Criteria

1. Similarities

For the most part, the results with a two-response criterion were very similar to those with a three-response criterion. Threshold estimates were about 2.5 dB above the 50% level for all but the lowest slopes for both two- and three-response criteria (Figure 1). The slope of the psychometric function had the same general effects on threshold estimates (Figure 1), standard deviation within and between levels (Figure 2), and the number of trials (Figure 3), for both two- and three-response criteria. That is, at lower slopes, the threshold was closer to the 50% point, the standard deviations within and across levels were larger, and the number of trials also was larger. The effect of hearing level on number of trials (Figure 4) was the same for both criteria. The stopping rules for two- and three-response criteria had the same rank order as measured by speed, although differences among

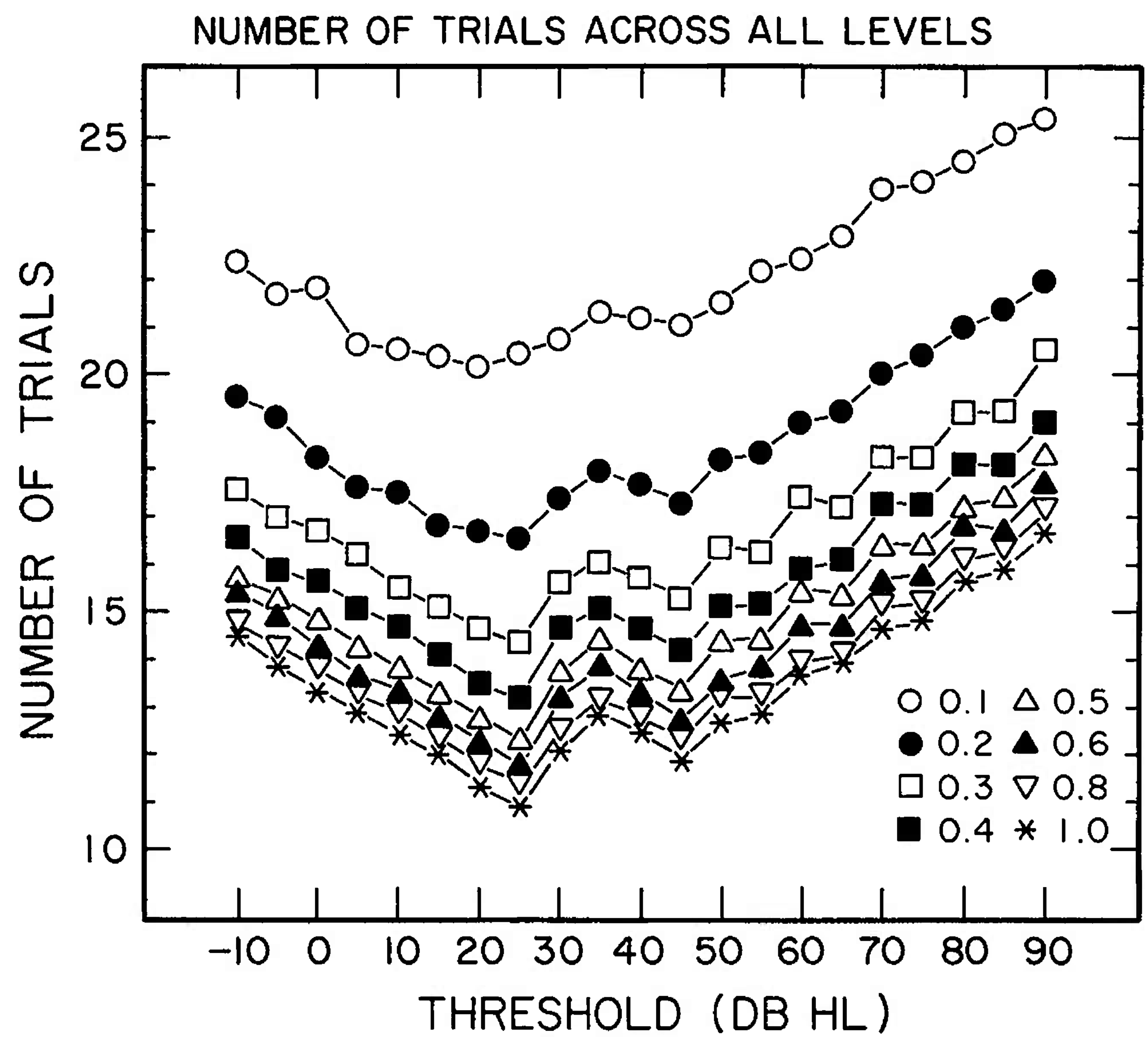

Figure 4. Number of trials at all hearing levels for one procedure (A-NO-3). The parameter is the slope of the simulated psychometric function.

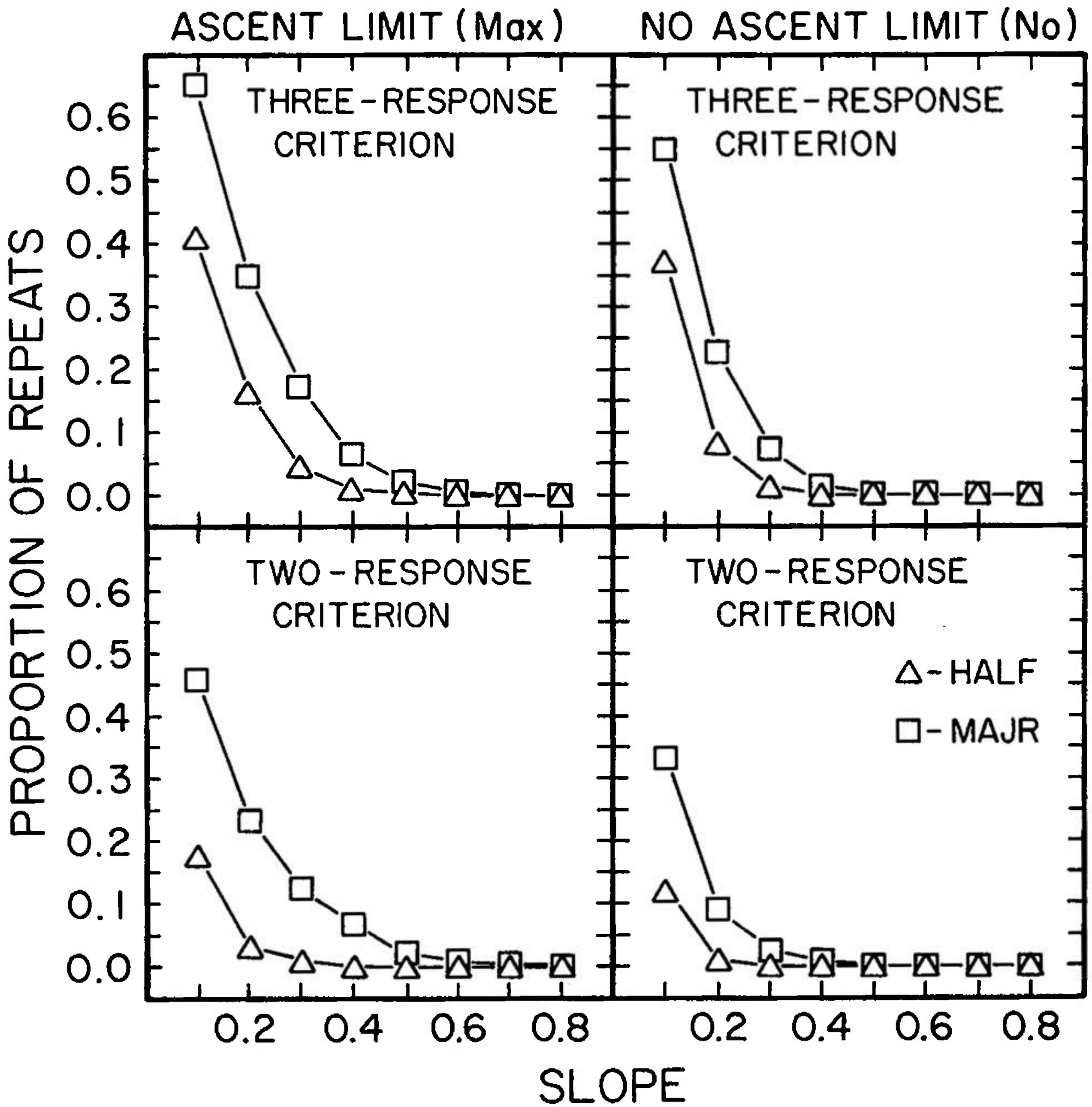

Figure 5. Proportion of tests that required repeats at 25 dB HL to meet the threshold criteria.

stopping rules were much smaller for the two-response criterion (Figure 3). The rank order based on proportion of threshold estimates that had to be repeated also was the same for the two-response criterion, and the same three stopping rules (A-NO, H-UP, and M-UP) did not require repeats to obtain a threshold estimate.

2. Differences

As expected, stopping rules using a two-response criterion required fewer trials to obtain a threshold estimate than did the stopping rules using a three-response criterion (Figure 3). For procedures differing only in two- or three-response criteria, the three-response criterion required an increase of roughly 1-1/2 times as many trials at all but the lowest slope (where the three-response criterion required roughly 2 to 2-1/2 times as many trials). The standard deviation within (measure of repeatability) was slightly larger for the two-response criterion in comparison to the three-response criterion (Figure 2), especially for lower slopes. That is, the procedures that require a minimum of three correct responses are more accurate but slower than those requiring only two correct responses. The improved accuracy is in rough agreement with expectations that accuracy should be proportional to the square root of the number of trials. Finally, the proportion of trials that had to be repeated in order to obtain threshold was lower for two-response than for three-response criteria (Figure 5).

3. Choice of criterion

Stopping rules using a two-response criterion are faster (number of trials) than stopping rules using a three-response criteria, at the expense of accuracy (repeatability). However, the standard deviations observed by simulation are smaller than those obtained experimentally, perhaps by a factor of two if compared to the results of Tyler and Wood (1980) and Marshall and Gossman (1982), shown in Table II. Sources of variability other than those due to test procedure include headphone placement, criterion variability, attention shifts, and changes in subjects' sensitivity over time. Earphone variance, however, is small (Shaw, 1966) relative to the obtained total variance, at least at 1000 Hz. Although earphone variance may play a role in determining total variance for higher and lower frequencies, the large standard deviations obtained at 1000 Hz demonstrate that, for thresholds obtained with actual listeners, sources of variance other than earphone placement are adding to the simulated threshold variance. Cognitive effects (criterion variability and attention) are difficult to separate from changes in sensitivity, but these combined factors also can limit the repeatability of threshold measurements.

Given that the variability due to the characteristics of the test procedure is not the limiting factor in determining observed variability for this group of psychophysical procedures, it is

TABLE II.

Test-retest measurements for ANSI (obtained but not reported as part of a study by Marshall and Gossman, 1982) and ASHA and shortened (two-response criterion) ASHA (Tyler and Wood, 1980). Earphones were removed and replaced i both studies. Marshall and Gossman used two threshold measurements, and their results are reported as standard errors of estimate (estimates of the standard deviations that would be obtained for repeated threshold measurements in individual listeners). Tyler and Wood measured thresholds 15 times, and their results are reported as standard deviations.

Procedure	Frequency in kHz 0.25	0.5	1.0	2.0	3.0	4.0	6.0	8.0
ANSI	4.1	2.9	3.2	3.9	3.2	3.4	6.3	5.5
ASHA	-	-	3.43	-	-	-	-	-
ASHA(S)	-	-	3.42	-	-	-	-	-

understandable that no improvement in reliability will be gained by using a minimum of three responses, a result observed by Tyler and Wood (1980). Thus, one probably is justified in using the faster method unless the observed standard deviations are comparable to those inherent in the test procedure as determined by the current simulations.

For the stopping rules using a two-response criterion, there was very little difference in speed among the four fastest (roughly one trial at a slope of 0.1 between the fastest and slowest). Thus, any of the four (A-NO-2, H-UP-2, M-UP-2, or H-MAX-2) could be used. However, as for the three-response stopping rules, the standard deviations of the number of trials at the shallowest slopes became progressively larger with the less efficient procedures, resulting in occasional unnecessarily long trials. We conclude that A-NO-2 is not only the easiest to implement, but also is slightly more efficient than the next best stopping rule. However, H-UP-2, M-UP-2, and H-MAX-2 are essentially equivalent to A-NO-2.

C. Application to Sonar Laboratory Research

In summary, results of audiological threshold test Monte Carlo simulations show that stopping rules using a two-response criterion are more rapid than those using a three-response criterion, at the expense of a small decrease in reliability. Differences among stopping rules are most apparent at shallow slopes, particularly for stopping rules using a three-response criterion. Half and majority rules are inefficient at shallow slopes, unless combined with an update rule, because responses are obtained at several levels and often no clear majority is obtained to terminate the test. Restarting the test after several series of ascents is less efficient than using updates to solve the problem caused by half and majority rules. The most efficient stopping rule is to omit half and majority rules altogether.

In order to consider whether a standard audiological procedure is useful for sonar laboratory research, several questions must be considered. First, what are the similarities and differences between this audiological procedure and the sonarman's task? Second, is the reliability of audiological procedures sufficient for auditory sonar research? Third, why is there a discrepancy between the test-retest reliability for the simulated subjects and for actual performance? What are the factors underlying determining the reliability of actual performance? How can their separate and combined magnitudes be measured? What improvements can be made in the procedures to increase their reliability? Fourth, are psychometric functions for pure-tone stimuli in quiet using naive listeners the same as those for sonar technicians (trained listeners) listening to complex sounds in complex backgrounds?

As discussed earlier, standard audiological procedures are in many respects similar to detection tasks in sonar operations. Undefined observation intervals are present for both, but the sonar task is more complicated. That is, once the sonar technician suspects that a target is present, he can listen at different bearings, which allows him to compare intervals with and without a signal. Free responses also are characteristic of both audiological procedures and at-sea operations. Thus, criterion effects can play a role in both, although not necessarily in the same way. In the laboratory, using an audiological procedure, the sonar technician can choose his own criterion, while at sea his criterion is influenced by operational considerations and the instructions of his supervisor. If these differences are not significant, then the overall similarity of audiological test procedures to sonar operations coupled with the speed of the procedure make the audiological procedure an attractive method for laboratory research. The reliability of audiological procedures, however, may be inadequate for research purposes.

For sonar operations, a 1-2 dB improvement in detection translates into a significant improvement in range. Therefore, in sonar signal-processing research it is desirable to be able to measure small differences among conditions. In order to do so, procedures must be used that have the highest possible reliability (within time constraints of data collection). The variability due to earphone placement combined with the variability inherent in even the best psychophysical procedures probably limits the standard deviation across a large number of repetitions to 1-1.5 dB. A 1.5 dB or lower standard deviation across repetitions therefore might be a good criterion for evaluating a psychophysical procedure for sonar signal-processing research. Our simulated results show standard deviations less than 1.5 dB only for slopes of 0.6 and higher. However, as mentioned earlier (see Table II), higher standard deviations are seen in actual practice.

There are at least two possible explanations why the standard deviations seen in actual practice are so much larger. First, if most listeners have fairly shallow slopes, the test-retest variability will be high enough to account for the difference between simulated and actual standard deviations. Figure 6, a histogram of the slopes for Marshall and Jesteadt's subjects, shows that shallow slopes do not characterize the majority of listeners. The predicted average test-retest variability given the slopes shown in Figure 6 is 2.08 dB, which is less than the standard errors found in actual practice. Also, slopes of psychometric functions for forced-choice procedures are not steeper than those for standard clinical procedures (Marshall and Jesteadt, 1986) yet give smaller test-retest errors. For example, standard errors of measurement (which are estimates of the standard deviation for an infinite number of replications) ranging from 1.1 to 1.8 dB for frequencies from 1000 to 4000 Hz were obtained as part of a study reported by Stelmachowicz et al. (1985), using an automated Bekesy yes-no tracking procedure (Stelmachowicz and Jesteadt, 1984).

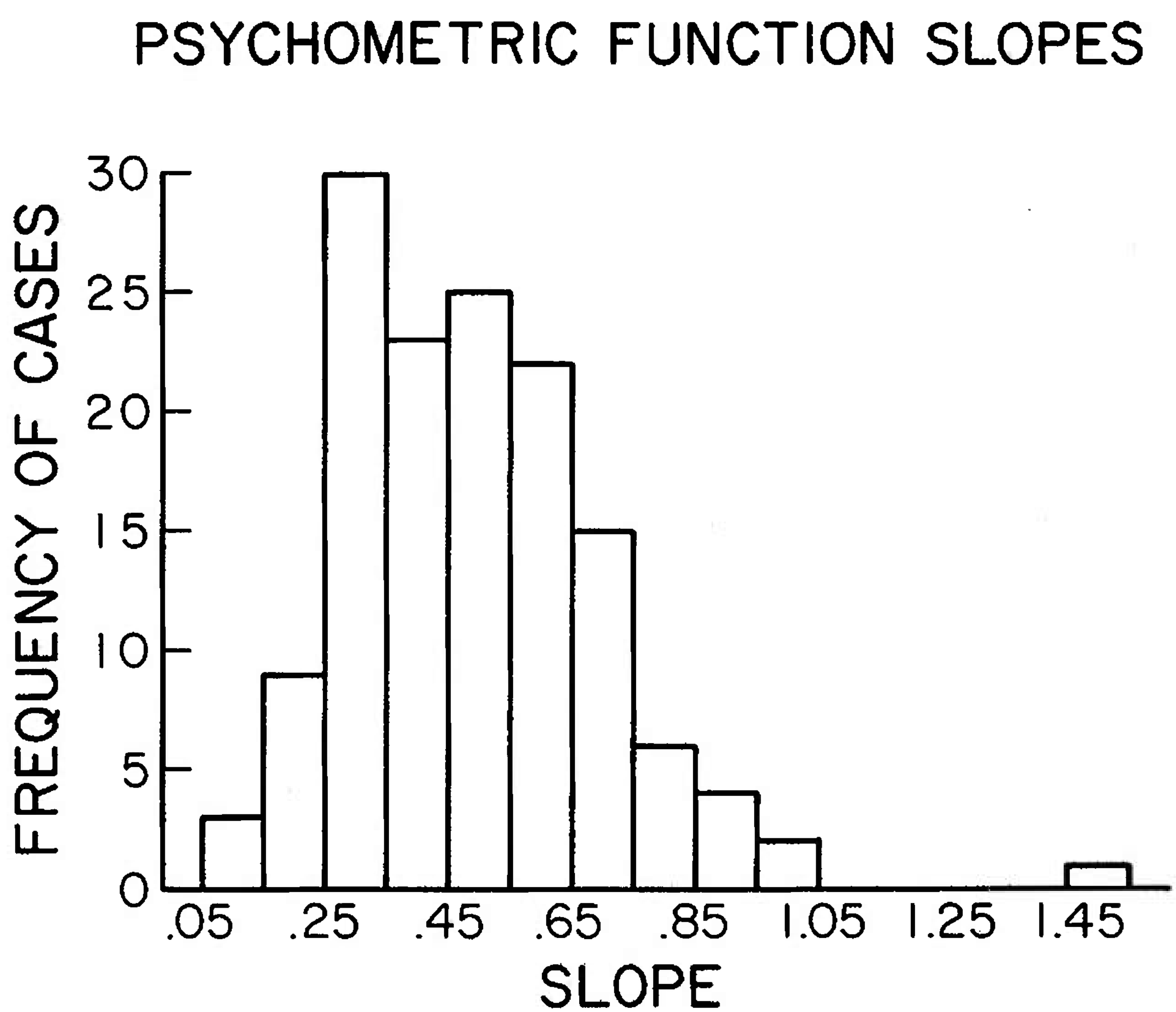

Figure 6. Frequency of cases as a function of psychometric function slope for psychometric functions obtained with a free-response, undefined-observation interval procedure (data from Marshall and Jesteadt, 1986).

Another possible explanation for the difference between simulated and actual performance is that our assumption of a stationary psychometric function is incorrect. If the psychometric function shifts back and forth so that, for example, at one moment a given stimulus level yields 100% detection and at another moment yields 0% detection, test-retest variability cannot be accurately modeled by a psychometric function based on averaged data over longer periods of time (e.g., the time required to obtain a minimum of 100 trials for each point on the psychometric function). In order for simulations with fixed psychometric functions to be valid, the psychometric function must be stable for as many trials as it takes to complete the procedure and its replications.

Watson et al. (1972) observed flatter psychometric functions for data collected across several days than for data collected within one session. Although the psychometric functions used in the present study were fit from data collected within one session, this time span still is too long to model moment-to-moment human performance. If listeners actually have extremely steep psychometric functions which shift back and forth along the x-axis (level) due to shifts in attention, criterion, and sensitivity, variability of actual performance as compared to simulated performance is increased, more so for those procedures that have the least control over attention and criterion, such as clinical procedures. It is extremely difficult, however, to measure these shifts because many data points are necessary at each level to provide a good estimate of the psychometric function.

To more accurately estimate instantaneous psychometric functions, Watson (personal communication) evaluated short-term detection performance relative to thresholds obtained by the method of adjustment. More specifically, using highly trained listeners, threshold (for 40 msec tones, both in isolation and as part of a tonal pattern) first was measured with the method of adjustment. Subsequently, twenty Yes-No trials (with a 50% probability of signal) were presented as quickly as possible to the subject at one sensation level relative to the method-of-adjustment level. For each block of trials, the sensation level was selected from plus or minus 1, 2, or 3 dB SL, as well as 0 dB SL. Psychometric functions for percent correct as a function of relative level were much steeper for these "instantaneous sensitivity" trials than the typical psychometric functions based on percent correct as a function of absolute level. Physiological data (growth of N1-P2 amplitude) collected in an analogous manner (Mast and Watson, 1968) also show very steep slopes.

In order to resolve differences between simulated and actual performance, we need to know how the psychometric function changes over time, both for defined and undefined observation intervals. Using relative levels as did Watson, but using more trials following each adjusted threshold and more repetitions (blocks of

trials), separate psychometric functions can be obtained for the first through the nth trial. Not only will a better understanding of short-term fluctuations improve our future Monte Carlo simulations, but, in addition, the comparison of defined and undefined observation intervals may identify a source of variability (uncertainty over the temporal occurrence of the signal) that will be fatal to our attempt to develop fast test procedures with minimum variability. That is, if defined observation intervals result in significantly less variability, then they should be used for our signal-processing research where the detection of small differences is important.

In order to apply the results of our stopping rule simulations to data collection with trained sonar technicians, we also need to know whether the distribution of psychometric functions for pure-tone stimuli with naive listeners is the same as for sonar technicians listening to real or simulated targets in realistic background noise. If the psychometric functions for sonar technicians in complex signal and noise conditions are uniformly steep, then any stopping rule can be used. However, if the slopes are low, then the choice of stopping rule has a considerable effect on the efficiency of the test. Lower slopes could be caused by very motivated and attentive subjects who respond to very low level as well as to higher level stimuli, which could be the case with sonar technicians.

In conclusion, additional research is necessary to determine what factors are responsible for the increased variability seen in actual performance as compared to simulated performance so that future Monte Carlo studies will accurately reflect actual performance and thus be more useful for evaluating test procedures. We also need to know the range of psychometric functions for sonar technicians listening to sonar-like signals in sea noise. With this information, we can better streamline our procedures while preserving their accuracy.

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Appendix A. Average Estimated Threshold in dB relative to the level yielding 50% correct.

Table A1. Average estimated threshold in dB for A-NO-3; i.e., first three congruent with no percent rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	0.83	2.13	2.76	2.82	2.66	2.72	2.68	2.72	2.63	2.63
-5	0.69	2.06	2.29	2.45	2.46	2.52	2.49	2.54	2.48	2.41
0	0.75	2.22	2.59	2.73	2.76	2.67	2.61	2.67	2.61	2.67
5	0.47	1.88	2.36	2.49	2.49	2.48	2.51	2.48	2.53	2.53
10	0.79	2.34	2.70	2.64	2.78	2.77	2.69	2.69	2.66	2.68
15	0.68	2.00	2.31	2.40	2.38	2.50	2.52	2.49	2.49	2.47
20	0.60	2.12	2.66	2.77	2.72	2.80	2.73	2.63	2.60	2.59
25	0.33	1.85	2.33	2.50	2.60	2.57	2.58	2.49	2.52	2.53
30	0.25	2.14	2.36	2.51	2.52	2.71	2.56	2.59	2.63	2.53
35	0.29	2.03	2.28	2.49	2.44	2.52	2.41	2.47	2.49	2.46
40	0.40	2.20	2.69	2.71	2.77	2.66	2.72	2.57	2.63	2.64
45	0.41	1.88	2.22	2.40	2.53	2.50	2.55	2.45	2.42	2.53
50	-0.04	1.89	2.41	2.57	2.72	2.56	2.61	2.53	2.60	2.54
55	-0.14	1.92	2.34	2.36	2.46	2.37	2.49	2.47	2.54	2.45
60	0.01	1.88	2.43	2.64	2.66	2.49	2.63	2.63	2.64	2.58
65	-0.01	1.98	2.27	2.48	2.45	2.36	2.57	2.45	2.53	2.53
70	0.07	2.11	2.62	2.49	2.59	2.62	2.63	2.60	2.59	2.59
75	0.07	2.00	2.26	2.44	2.41	2.50	2.43	2.50	2.48	2.50
80	-0.12	2.07	2.27	2.67	2.53	2.55	2.57	2.62	2.59	2.54
85	0.06	1.82	2.30	2.48	2.56	2.46	2.53	2.43	2.47	2.52
90	0.28	1.89	2.41	2.56	2.65	2.61	2.57	2.55	2.57	2.56

Table A2. Average estimated threshold in dB for H-UP-3; i.e., three congruent out of last six (half rule with updates), no limit on number of ascents.

-10	0.12	2.03	2.71	2.69	2.76	2.71	2.65	2.65	2.67	2.56
-5	0.69	1.95	2.24	2.43	2.53	2.57	2.46	2.42	2.45	2.44
0	0.38	2.28	2.60	2.63	2.82	2.73	2.63	2.65	2.62	2.60
5	0.26	2.06	2.33	2.56	2.55	2.49	2.45	2.45	2.48	2.61
10	0.22	2.19	2.59	2.78	2.69	2.67	2.76	2.72	2.66	2.63
15	0.44	1.90	2.35	2.46	2.53	2.50	2.55	2.48	2.49	2.51
20	0.34	2.24	2.71	2.71	2.79	2.70	2.70	2.70	2.56	2.58
25	0.16	1.95	2.27	2.44	2.53	2.49	2.55	2.58	2.51	2.44
30	0.10	1.95	2.47	2.59	2.69	2.56	2.58	2.59	2.56	2.54
35	0.06	2.07	2.30	2.39	2.38	2.57	2.47	2.52	2.54	2.49
40	0.34	2.15	2.56	2.72	2.76	2.67	2.58	2.63	2.60	2.62
45	0.08	1.80	2.35	2.40	2.48	2.43	2.46	2.49	2.55	2.53
50	-0.08	1.89	2.45	2.63	2.59	2.56	2.57	2.57	2.58	2.62
55	-0.12	1.73	2.34	2.57	2.42	2.55	2.49	2.45	2.49	2.49
60	-0.03	1.97	2.45	2.56	2.63	2.67	2.54	2.56	2.60	2.54
65	0.06	1.68	2.26	2.42	2.49	2.51	2.59	2.53	2.54	2.56
70	0.01	2.06	2.52	2.49	2.63	2.59	2.57	2.59	2.59	2.57
75	-0.41	1.85	2.13	2.50	2.50	2.54	2.54	2.46	2.51	2.56
80	0.23	2.08	2.38	2.60	2.57	2.63	2.62	2.61	2.60	2.60
85	0.05	1.83	2.27	2.46	2.49	2.45	2.48	2.52	2.50	2.53
90	0.05	1.88	2.42	2.55	2.64	2.67	2.53	2.50	2.57	2.57

Table A3. Average estimated threshold in dB for M-UP-3; i.e., three congruent out of last five (majority rule with updates), no limit on number of ascents.

					SLOPES					
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	0.19	2.08	2.57	2.64	2.71	2.65	2.67	2.61	2.61	2.66
-5	0.35	2.06	2.28	2.40	2.38	2.55	2.48	2.56	2.56	2.49
0	0.13	2.06	2.48	2.74	2.70	2.72	2.66	2.66	2.59	2.61
5	-0.02	1.91	2.29	2.47	2.45	2.47	2.49	2.55	2.43	2.53
10	0.32	1.89	2.56	2.70	2.64	2.70	2.65	2.62	2.61	2.61
15	0.03	1.91	2.36	2.54	2.51	2.56	2.41	2.59	2.54	2.53
20	0.20	2.01	2.57	2.64	2.74	2.69	2.69	2.67	2.62	2.66
25	0.17	1.74	2.32	2.41	2.48	2.54	2.57	2.48	2.52	2.63
30	0.00	1.84	2.31	2.49	2.57	2.62	2.60	2.62	2.57	2.58
35	-0.05	2.06	2.22	2.51	2.45	2.49	2.51	2.56	2.50	2.58
40	0.12	1.98	2.61	2.68	2.78	2.72	2.69	2.62	2.53	2.54
45	0.10	1.97	2.20	2.32	2.50	2.48	2.47	2.46	2.51	2.46
50	0.05	1.75	2.37	2.61	2.64	2.59	2.53	2.58	2.54	2.54
55	-0.07	1.77	2.32	2.41	2.40	2.49	2.48	2.51	2.57	2.50
60	-0.03	1.93	2.49	2.59	2.58	2.56	2.60	2.73	2.59	2.55
65	-0.05	1.77	2.43	2.47	2.54	2.50	2.43	2.48	2.46	2.51
70	0.06	1.97	2.38	2.54	2.66	2.67	2.67	2.63	2.67	2.59
75	0.12	1.90	2.38	2.33	2.46	2.56	2.46	2.42	2.49	2.49
80	-0.28	1.86	2.49	2.56	2.50	2.58	2.62	2.55	2.62	2.54
85	-0.04	1.86	2.27	2.35	2.46	2.50	2.47	2.47	2.55	2.51
90	-0.34	1.76	2.40	2.57	2.49	2.66	2.59	2.55	2.58	2.60

Table A4. Average estimated threshold in dB for H-MAX-3; i.e., three congruent with six ascent limit (half rule with limit on the number of ascents), no update.

-10	1.02	2.18	2.70	2.69	2.77	2.70	2.67	2.60	2.63	2.67
-5	1.26	2.02	2.39	2.45	2.52	2.49	2.52	2.55	2.49	2.53
0	1.15	2.31	2.62	2.74	2.72	2.66	2.69	2.62	2.67	2.65
5	1.32	1.96	2.34	2.57	2.39	2.48	2.46	2.44	2.44	2.52
10	1.07	2.35	2.77	2.67	2.81	2.77	2.66	2.63	2.59	2.60
15	1.11	2.15	2.23	2.48	2.52	2.49	2.54	2.51	2.54	2.54
20	0.92	2.19	2.59	2.74	2.71	2.72	2.72	2.61	2.65	2.63
25	0.52	1.84	2.34	2.44	2.45	2.46	2.50	2.52	2.44	2.57
30	0.38	2.15	2.44	2.56	2.58	2.57	2.54	2.57	2.58	2.52
35	0.38	1.97	2.32	2.47	2.61	2.60	2.49	2.45	2.47	2.45
40	0.69	2.14	2.65	2.73	2.68	2.63	2.66	2.66	2.68	2.64
45	0.38	1.93	2.22	2.50	2.52	2.56	2.47	2.52	2.52	2.44
50	0.36	2.13	2.40	2.59	2.62	2.62	2.61	2.61	2.60	2.62
55	0.01	1.98	2.35	2.38	2.47	2.48	2.45	2.47	2.47	2.53
60	0.19	1.97	2.55	2.46	2.61	2.64	2.57	2.58	2.60	2.54
65	0.36	2.00	2.27	2.39	2.46	2.47	2.57	2.52	2.49	2.47
70	0.17	1.92	2.38	2.68	2.58	2.57	2.58	2.57	2.55	2.58
75	-0.10	1.86	2.18	2.43	2.38	2.44	2.59	2.57	2.55	2.53
80	0.01	1.73	2.40	2.59	2.55	2.53	2.52	2.57	2.56	2.58
85	0.09	1.84	2.41	2.46	2.57	2.57	2.46	2.51	2.52	2.43
90	0.01	2.24	2.34	2.55	2.56	2.61	2.67	2.57	2.52	2.55

Table A5. Average estimated threshold in dB for H-NO-3; i.e., three congruent with half rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	1.12	2.36	2.74	2.65	2.58	2.77	2.72	2.62	2.62	2.62
-5	1.09	2.04	2.45	2.42	2.44	2.46	2.52	2.58	2.45	2.48
0	1.19	2.23	2.59	2.69	2.73	2.64	2.65	2.59	2.64	2.64
5	1.09	2.01	2.50	2.38	2.48	2.53	2.49	2.51	2.52	2.49
10	1.02	2.15	2.73	2.76	2.63	2.75	2.65	2.68	2.64	2.57
15	0.93	1.91	2.35	2.54	2.53	2.55	2.53	2.49	2.54	2.48
20	0.54	2.04	2.67	2.66	2.68	2.68	2.71	2.70	2.66	2.58
25	0.48	2.01	2.38	2.42	2.37	2.52	2.51	2.51	2.53	2.54
30	0.31	2.00	2.41	2.54	2.63	2.60	2.68	2.63	2.58	2.53
35	0.43	1.90	2.38	2.53	2.42	2.58	2.56	2.43	2.48	2.40
40	0.47	2.33	2.47	2.72	2.70	2.71	2.67	2.66	2.62	2.61
45	0.67	2.04	2.35	2.44	2.56	2.43	2.44	2.43	2.52	2.54
50	0.22	2.03	2.51	2.68	2.49	2.55	2.64	2.63	2.58	2.57
55	0.21	2.03	2.36	2.42	2.38	2.51	2.53	2.51	2.46	2.44
60	0.14	1.87	2.40	2.59	2.57	2.66	2.55	2.52	2.56	2.55
65	0.28	1.95	2.41	2.45	2.49	2.45	2.47	2.49	2.40	2.46
70	0.22	1.93	2.59	2.61	2.67	2.63	2.63	2.58	2.54	2.65
75	0.31	1.92	2.22	2.44	2.53	2.46	2.47	2.54	2.54	2.57
80	0.07	2.00	2.36	2.59	2.64	2.63	2.54	2.62	2.56	2.56
85	0.00	1.83	2.16	2.41	2.42	2.48	2.54	2.48	2.54	2.57
90	0.06	2.16	2.48	2.62	2.65	2.66	2.53	2.56	2.59	2.58

Table A6. Average estimated threshold in dB for M-MAX-3; i.e., three congruent with five ascent limit (majority rule with limit on the number of ascents), no update.

-10	1.71	2.49	2.81	2.77	2.74	2.64	2.65	2.63	2.67	2.58
-5	1.65	1.97	2.33	2.41	2.45	2.42	2.46	2.56	2.59	2.52
0	1.84	2.41	2.58	2.74	2.75	2.66	2.63	2.68	2.64	2.56
5	1.75	2.05	2.21	2.57	2.51	2.52	2.57	2.49	2.51	2.50
10	1.48	2.35	2.61	2.72	2.64	2.68	2.68	2.67	2.62	2.60
15	1.24	1.96	2.27	2.44	2.50	2.55	2.56	2.53	2.48	2.51
20	1.02	2.30	2.59	2.81	2.73	2.71	2.59	2.65	2.65	2.57
25	0.69	2.15	2.27	2.47	2.57	2.52	2.40	2.49	2.45	2.45
30	0.54	2.15	2.45	2.68	2.56	2.55	2.61	2.59	2.57	2.57
35	0.75	2.06	2.36	2.47	2.52	2.53	2.52	2.54	2.46	2.45
40	0.89	2.32	2.62	2.72	2.89	2.67	2.65	2.61	2.68	2.63
45	0.56	1.98	2.35	2.51	2.63	2.51	2.53	2.50	2.42	2.44
50	0.44	2.02	2.48	2.51	2.55	2.61	2.55	2.63	2.59	2.49
55	0.16	1.99	2.36	2.47	2.47	2.47	2.52	2.49	2.45	2.52
60	0.16	2.04	2.44	2.66	2.60	2.61	2.58	2.55	2.58	2.57
65	0.05	1.79	2.32	2.45	2.41	2.55	2.56	2.54	2.49	2.56
70	0.37	1.97	2.50	2.45	2.61	2.57	2.61	2.60	2.60	2.59
75	0.34	1.96	2.27	2.57	2.59	2.55	2.53	2.47	2.45	2.56
80	0.41	2.06	2.40	2.54	2.73	2.61	2.60	2.64	2.55	2.58
85	0.41	1.92	2.24	2.39	2.51	2.53	2.51	2.53	2.45	2.46
90	0.41	2.08	2.49	2.61	2.54	2.63	2.56	2.63	2.59	2.59

Table A7. Average estimated threshold in dB for M-NO-3; i.e., three congruent with majority rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	1.01	2.18	2.63	2.74	2.64	2.75	2.67	2.67	2.68	2.67
-5	1.25	2.12	2.38	2.40	2.43	2.52	2.58	2.48	2.53	2.47
0	1.31	2.23	2.53	2.69	2.76	2.61	2.69	2.60	2.62	2.63
5	1.18	2.01	2.38	2.40	2.55	2.57	2.46	2.49	2.48	2.50
10	1.22	2.30	2.61	2.70	2.72	2.69	2.61	2.69	2.60	2.70
15	1.00	1.87	2.46	2.44	2.59	2.49	2.45	2.48	2.52	2.47
20	1.13	2.17	2.63	2.64	2.63	2.70	2.72	2.65	2.67	2.63
25	0.43	1.89	2.51	2.45	2.53	2.54	2.39	2.53	2.57	2.52
30	0.68	2.04	2.42	2.50	2.59	2.65	2.63	2.56	2.61	2.55
35	0.57	1.89	2.37	2.35	2.34	2.50	2.47	2.51	2.56	2.47
40	0.67	2.31	2.56	2.82	2.73	2.63	2.76	2.65	2.58	2.63
45	0.56	1.97	2.32	2.45	2.48	2.49	2.39	2.46	2.54	2.43
50	0.20	2.07	2.49	2.53	2.56	2.72	2.56	2.64	2.60	2.53
55	0.09	1.90	2.26	2.41	2.44	2.53	2.49	2.48	2.45	2.51
60	0.18	2.11	2.49	2.60	2.58	2.62	2.56	2.61	2.54	2.59
65	0.12	1.84	2.34	2.46	2.50	2.49	2.56	2.52	2.51	2.55
70	0.35	1.93	2.58	2.46	2.64	2.57	2.58	2.58	2.57	2.59
75	0.22	2.01	2.38	2.39	2.45	2.50	2.43	2.43	2.54	2.55
80	0.17	1.96	2.41	2.61	2.66	2.64	2.57	2.52	2.61	2.61
85	0.14	1.91	2.29	2.38	2.51	2.53	2.49	2.51	2.49	2.46
90	0.26	2.19	2.50	2.54	2.67	2.60	2.51	2.59	2.57	2.61

Table A8. Average estimated threshold in dB for A-NO-2; i.e., first two congruent with no percent rule, no limit on number of ascents, no update.

-10	1.43	2.50	2.86	2.81	2.86	2.89	2.68	2.72	2.76	2.69
-5	1.33	2.23	2.36	2.40	2.59	2.45	2.48	2.45	2.47	2.56
0	1.47	2.13	2.70	2.87	2.87	2.82	2.80	2.67	2.73	2.62
5	1.25	2.24	2.39	2.34	2.57	2.52	2.56	2.46	2.46	2.48
10	1.46	2.46	2.88	2.77	2.87	2.79	2.80	2.76	2.73	2.69
15	1.37	2.14	2.44	2.53	2.43	2.49	2.56	2.55	2.53	2.57
20	0.80	2.50	2.91	2.74	2.84	2.84	2.72	2.78	2.69	2.69
25	0.89	2.08	2.40	2.34	2.59	2.47	2.51	2.48	2.52	2.55
30	0.45	2.16	2.60	2.63	2.68	2.66	2.63	2.72	2.62	2.62
35	0.82	2.05	2.35	2.51	2.61	2.55	2.49	2.53	2.54	2.50
40	0.70	2.14	2.66	2.78	2.84	2.84	2.82	2.75	2.71	2.65
45	0.83	1.92	2.35	2.48	2.59	2.53	2.36	2.43	2.48	2.51
50	0.48	2.12	2.56	2.51	2.82	2.63	2.63	2.64	2.66	2.59
55	0.35	2.12	2.42	2.48	2.44	2.52	2.49	2.44	2.48	2.47
60	0.22	2.08	2.50	2.63	2.65	2.61	2.65	2.62	2.57	2.53
65	0.41	2.04	2.43	2.34	2.49	2.47	2.55	2.43	2.46	2.44
70	0.17	2.04	2.53	2.60	2.77	2.62	2.63	2.63	2.62	2.55
75	0.22	1.93	2.43	2.48	2.46	2.59	2.58	2.52	2.45	2.54
80	0.09	2.19	2.76	2.72	2.63	2.67	2.62	2.64	2.63	2.64
85	0.38	1.78	2.57	2.38	2.46	2.42	2.49	2.49	2.47	2.45
90	0.19	2.11	2.49	2.60	2.69	2.58	2.66	2.63	2.52	2.63

Table A9. Average estimated threshold in dB for H-UP-2; i.e., two congruent out of last four (half rule with update), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	1.31	2.62	2.75	2.80	2.82	2.75	2.80	2.79	2.71	2.65
-5	1.16	2.23	2.53	2.49	2.53	2.56	2.45	2.51	2.48	2.55
0	1.26	2.37	2.60	2.89	2.83	2.78	2.70	2.71	2.68	2.66
5	1.04	2.17	2.36	2.38	2.44	2.48	2.56	2.45	2.51	2.54
10	1.13	2.45	2.77	2.92	2.86	2.81	2.75	2.85	2.67	2.66
15	1.15	2.20	2.53	2.46	2.59	2.52	2.45	2.46	2.46	2.44
20	1.01	2.52	2.81	2.85	3.00	2.73	2.78	2.76	2.72	2.65
25	0.76	1.97	2.41	2.59	2.65	2.54	2.44	2.51	2.57	2.49
30	0.54	2.00	2.46	2.63	2.68	2.68	2.63	2.65	2.63	2.60
35	0.74	2.06	2.30	2.56	2.46	2.55	2.53	2.60	2.51	2.41
40	0.80	2.23	2.77	2.80	2.76	2.85	2.74	2.69	2.81	2.65
45	0.47	2.00	2.23	2.46	2.56	2.49	2.53	2.51	2.51	2.47
50	0.50	1.99	2.47	2.62	2.72	2.66	2.71	2.59	2.61	2.61
55	0.37	2.11	2.27	2.41	2.40	2.55	2.56	2.47	2.45	2.55
60	0.28	2.05	2.59	2.68	2.69	2.72	2.66	2.62	2.56	2.60
65	0.44	2.04	2.29	2.54	2.53	2.49	2.54	2.41	2.51	2.53
70	0.21	1.95	2.55	2.72	2.68	2.61	2.69	2.63	2.55	2.58
75	0.06	1.95	2.46	2.54	2.47	2.54	2.48	2.40	2.45	2.43
80	0.19	2.10	2.55	2.60	2.60	2.78	2.61	2.57	2.62	2.53
85	0.46	1.77	2.39	2.38	2.47	2.59	2.47	2.45	2.55	2.55
90	0.03	2.07	2.49	2.65	2.65	2.69	2.68	2.62	2.53	2.62

Table A10. Average estimated threshold in dB for M-UP-2; i.e., two congruent out of last three (majority rule with updates), no limit on number of ascents.

-10	0.99	2.24	2.78	2.77	2.81	2.86	2.77	2.84	2.70	2.70
-5	0.89	2.17	2.43	2.56	2.52	2.39	2.53	2.41	2.54	2.48
0	1.20	2.27	2.62	2.85	2.88	2.76	2.85	2.74	2.78	2.67
5	1.00	2.02	2.38	2.38	2.54	2.49	2.42	2.59	2.59	2.52
10	1.07	2.28	2.79	2.97	2.92	2.88	2.76	2.63	2.77	2.73
15	0.96	1.94	2.42	2.38	2.46	2.53	2.48	2.54	2.45	2.49
20	0.87	2.46	2.72	2.80	2.83	2.89	2.84	2.79	2.73	2.62
25	0.60	1.75	2.28	2.43	2.48	2.44	2.52	2.51	2.49	2.44
30	0.47	2.06	2.64	2.68	2.70	2.63	2.71	2.62	2.59	2.62
35	0.28	1.99	2.34	2.48	2.52	2.49	2.57	2.44	2.44	2.57
40	0.66	2.33	2.74	2.83	2.71	2.79	2.80	2.72	2.70	2.74
45	0.55	2.08	2.25	2.41	2.48	2.54	2.44	2.62	2.52	2.54
50	0.04	1.88	2.55	2.51	2.75	2.66	2.66	2.63	2.63	2.58
55	0.35	2.00	2.44	2.58	2.51	2.55	2.51	2.45	2.55	2.49
60	0.61	2.01	2.35	2.59	2.61	2.69	2.58	2.74	2.61	2.62
65	0.17	1.98	2.31	2.38	2.53	2.52	2.51	2.48	2.51	2.44
70	0.29	2.02	2.43	2.63	2.66	2.67	2.62	2.69	2.67	2.60
75	0.29	2.08	2.45	2.53	2.48	2.44	2.59	2.53	2.53	2.59
80	0.40	2.13	2.38	2.64	2.60	2.66	2.68	2.61	2.64	2.55
85	0.10	1.93	2.35	2.48	2.40	2.48	2.49	2.43	2.55	2.51
90	0.47	1.91	2.47	2.65	2.70	2.64	2.70	2.66	2.61	2.64

Table A11. Average estimated threshold in dB for H-MAX-2; i.e., two congruent with four ascent limit (half rule with limit on the number of ascents), no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	2.06	2.38	2.76	2.92	2.78	2.80	2.79	2.70	2.63	2.64
-5	2.08	2.28	2.49	2.58	2.41	2.50	2.54	2.54	2.53	2.46
0	1.96	2.42	2.71	2.89	2.82	2.79	2.76	2.70	2.76	2.71
5	2.18	2.27	2.45	2.39	2.50	2.58	2.47	2.51	2.52	2.55
10	1.81	2.48	2.83	2.86	2.84	2.80	2.71	2.72	2.74	2.67
15	1.63	2.40	2.49	2.47	2.42	2.49	2.48	2.51	2.45	2.46
20	1.59	2.38	2.73	2.80	3.00	2.80	2.76	2.66	2.69	2.65
25	1.03	1.97	2.31	2.42	2.51	2.53	2.37	2.47	2.46	2.52
30	1.02	2.07	2.45	2.64	2.69	2.78	2.64	2.58	2.69	2.52
35	0.85	2.15	2.34	2.50	2.48	2.46	2.54	2.52	2.55	2.46
40	1.17	2.38	2.80	2.86	2.88	2.87	2.79	2.79	2.75	2.69
45	1.07	2.13	2.18	2.43	2.43	2.40	2.51	2.41	2.45	2.53
50	0.34	2.13	2.55	2.63	2.66	2.61	2.61	2.60	2.62	2.56
55	0.62	1.88	2.37	2.41	2.51	2.44	2.42	2.46	2.46	2.40
60	0.75	2.22	2.32	2.65	2.64	2.59	2.75	2.63	2.61	2.59
65	0.34	2.01	2.34	2.46	2.56	2.54	2.53	2.56	2.45	2.47
70	0.26	1.94	2.52	2.54	2.65	2.76	2.62	2.65	2.62	2.60
75	0.43	2.02	2.33	2.38	2.44	2.51	2.57	2.48	2.49	2.48
80	0.53	2.01	2.57	2.58	2.61	2.60	2.63	2.68	2.61	2.64
85	0.22	1.99	2.18	2.46	2.36	2.48	2.51	2.53	2.57	2.53
90	0.40	2.00	2.53	2.56	2.69	2.63	2.70	2.59	2.69	2.56

Table A12. Average estimated threshold in dB for H-NO-2; i.e., two congruent with half rule, no limit on number of ascent, no update.

-10	1.81	2.48	2.73	2.93	2.90	2.86	2.82	2.79	2.68	2.62
-5	1.95	2.16	2.34	2.51	2.45	2.37	2.47	2.44	2.50	2.52
0	1.72	2.49	2.83	2.91	2.83	2.90	2.78	2.80	2.78	2.63
5	1.76	2.18	2.54	2.41	2.56	2.45	2.49	2.49	2.49	2.52
10	1.65	2.62	2.96	2.94	2.88	2.84	2.88	2.71	2.62	2.72
15	1.67	2.22	2.35	2.54	2.52	2.51	2.49	2.49	2.48	2.43
20	1.40	2.52	2.90	2.92	2.92	2.74	2.79	2.76	2.69	2.70
25	1.23	2.11	2.26	2.55	2.44	2.59	2.57	2.51	2.48	2.46
30	0.84	2.02	2.36	2.48	2.63	2.69	2.63	2.64	2.66	2.64
35	0.86	2.13	2.46	2.64	2.50	2.48	2.53	2.49	2.49	2.56
40	1.01	2.30	2.85	2.81	2.82	2.85	2.88	2.88	2.78	2.70
45	0.95	2.11	2.37	2.40	2.47	2.48	2.49	2.60	2.48	2.52
50	0.44	2.15	2.44	2.57	2.78	2.76	2.63	2.68	2.63	2.61
55	0.56	1.94	2.26	2.37	2.42	2.44	2.52	2.52	2.50	2.52
60	0.43	2.11	2.50	2.59	2.66	2.63	2.55	2.63	2.57	2.67
65	0.25	1.83	2.30	2.51	2.42	2.64	2.54	2.42	2.42	2.49
70	0.56	2.13	2.47	2.60	2.71	2.66	2.72	2.64	2.57	2.59
75	0.19	2.03	2.41	2.35	2.49	2.45	2.47	2.61	2.50	2.52
80	0.38	2.10	2.57	2.64	2.64	2.73	2.61	2.60	2.55	2.64
85	0.26	2.04	2.32	2.73	2.48	2.42	2.57	2.49	2.45	2.53
90	0.19	2.05	2.51	2.62	2.67	2.59	2.58	2.60	2.61	2.54

Table A13. Average estimated threshold in dB for M-MAX-2; i.e., two congruent with three ascent limit (majority rule with limit on the number of ascents), no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	3.13	2.76	2.84	2.94	2.84	2.78	2.73	2.80	2.68	2.68
-5	2.95	2.29	2.51	2.52	2.62	2.48	2.60	2.50	2.52	2.47
0	3.07	2.63	2.90	2.91	2.94	2.83	2.79	2.71	2.66	2.58
5	3.21	2.58	2.76	2.58	2.61	2.51	2.41	2.51	2.45	2.43
10	2.66	2.70	3.02	2.90	2.81	2.85	2.77	2.73	2.76	2.71
15	2.80	2.49	2.37	2.51	2.50	2.59	2.43	2.53	2.63	2.44
20	2.22	2.69	2.99	2.80	2.75	2.84	2.79	2.77	2.68	2.77
25	1.47	2.15	2.42	2.40	2.46	2.53	2.57	2.51	2.54	2.50
30	1.35	2.14	2.60	2.61	2.70	2.63	2.76	2.62	2.72	2.55
35	1.54	2.38	2.60	2.41	2.40	2.45	2.47	2.53	2.56	2.46
40	1.48	2.54	2.98	2.92	2.90	2.90	2.69	2.76	2.71	2.76
45	1.35	2.27	2.33	2.60	2.40	2.49	2.45	2.43	2.53	2.58
50	0.97	1.95	2.41	2.50	2.65	2.59	2.70	2.58	2.70	2.63
55	0.65	2.12	2.38	2.50	2.41	2.53	2.53	2.55	2.52	2.51
60	0.47	2.22	2.48	2.56	2.67	2.74	2.64	2.71	2.55	2.61
65	0.58	2.05	2.41	2.44	2.43	2.44	2.47	2.53	2.56	2.50
70	0.58	2.18	2.64	2.68	2.79	2.70	2.66	2.61	2.63	2.63
75	0.75	2.15	2.43	2.51	2.49	2.44	2.61	2.43	2.52	2.58
80	0.43	2.23	2.43	2.58	2.67	2.60	2.62	2.58	2.60	2.63
85	0.52	2.05	2.38	2.36	2.50	2.48	2.47	2.44	2.50	2.57
90	0.41	2.04	2.57	2.69	2.66	2.66	2.65	2.57	2.64	2.63

Table A14. Average estimated threshold in dB for M-NO-2; i.e., two congruent with majority rule, no limit on number of ascents, no update.

-10	2.24	2.52	2.87	2.89	2.82	2.80	2.76	2.70	2.72	2.65
-5	2.23	2.27	2.40	2.44	2.46	2.45	2.49	2.51	2.46	2.55
0	2.15	2.38	2.63	2.90	2.86	2.88	2.70	2.65	2.74	2.73
5	2.22	2.33	2.46	2.60	2.49	2.48	2.56	2.41	2.56	2.47
10	2.43	2.47	2.80	2.80	2.87	2.81	2.81	2.78	2.86	2.78
15	2.14	2.32	2.29	2.47	2.42	2.47	2.49	2.51	2.55	2.54
20	1.57	2.35	2.90	2.84	2.82	2.84	2.79	2.74	2.72	2.82
25	1.05	1.98	2.44	2.52	2.42	2.58	2.53	2.52	2.54	2.49
30	0.90	2.18	2.49	2.67	2.63	2.59	2.66	2.57	2.48	2.61
35	1.03	2.24	2.41	2.48	2.48	2.45	2.40	2.49	2.42	2.40
40	1.01	2.59	2.73	2.83	2.92	2.87	2.84	2.80	2.71	2.77
45	0.75	2.08	2.40	2.51	2.48	2.42	2.57	2.55	2.51	2.44
50	0.44	2.08	2.48	2.57	2.67	2.67	2.63	2.66	2.62	2.60
55	0.62	2.08	2.41	2.45	2.39	2.48	2.59	2.49	2.48	2.49
60	0.53	2.06	2.51	2.69	2.67	2.75	2.63	2.71	2.55	2.55
65	0.30	1.99	2.42	2.37	2.53	2.57	2.41	2.53	2.43	2.52
70	0.20	2.08	2.55	2.54	2.64	2.67	2.65	2.65	2.54	2.56
75	0.51	2.01	2.32	2.31	2.46	2.60	2.55	2.47	2.60	2.56
80	0.22	2.09	2.49	2.64	2.72	2.68	2.60	2.67	2.66	2.63
85	0.41	1.82	2.37	2.46	2.53	2.51	2.48	2.43	2.41	2.51
90	0.25	2.10	2.54	2.47	2.57	2.76	2.63	2.65	2.62	2.52

Appendix B. Average Reliability of Threshold Estimates in dB

Table B1. Reliability (average standard deviation) for A-NO-3; i.e., first three congruent with no percent rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.55	2.99	2.28	1.84	1.63	1.44	1.12	1.01	0.78	0.87
-5	4.45	2.91	2.32	1.99	1.59	1.49	1.23	1.08	0.78	0.88
0	4.58	2.98	2.33	1.87	1.61	1.37	1.10	1.05	0.81	0.82
5	4.43	2.86	2.32	1.98	1.65	1.39	1.25	1.14	1.03	0.81
10	4.64	2.93	2.27	1.74	1.62	1.31	1.25	0.95	0.99	0.82
15	4.49	3.03	2.33	1.78	1.69	1.28	1.20	1.12	0.85	0.81
20	4.47	3.09	2.27	1.92	1.53	1.24	1.08	0.95	0.93	0.82
25	4.47	2.85	2.36	1.84	1.58	1.36	1.09	0.97	0.96	0.74
30	4.44	3.04	2.32	1.87	1.63	1.29	1.02	0.91	0.99	0.78
35	4.73	3.03	2.36	1.96	1.73	1.31	1.06	1.10	1.01	0.74
40	4.55	2.99	2.29	1.99	1.63	1.40	1.15	0.98	0.82	0.79
45	4.46	2.90	2.34	1.93	1.60	1.45	1.17	1.13	0.90	0.83
50	4.44	3.02	2.33	1.92	1.61	1.36	1.11	1.05	1.07	0.79
55	4.30	2.91	2.38	1.88	1.61	1.22	1.19	1.01	0.87	0.85
60	4.46	2.97	2.33	1.89	1.71	1.31	1.03	1.04	0.82	0.83
65	4.12	2.94	2.34	1.86	1.56	1.48	1.30	1.00	0.84	0.88
70	4.46	2.93	2.27	1.93	1.58	1.30	1.11	1.00	0.84	0.75
75	4.68	2.98	2.41	1.94	1.60	1.49	1.21	1.16	0.88	0.80
80	4.43	2.91	2.31	1.87	1.59	1.34	1.07	0.96	0.88	0.74
85	4.48	2.82	2.35	1.91	1.68	1.44	1.13	0.99	0.87	0.76
90	4.50	2.89	2.33	1.88	1.48	1.37	1.08	0.97	0.92	0.78

Table B2. Reliability (average standard deviation) for H-UP-3; i.e., three congruent out of last six (half rule with updates), no limit on number of ascents.

-10	4.40	3.09	2.28	1.91	1.59	1.19	1.23	0.96	0.89	0.93
-5	4.57	2.89	2.26	1.82	1.66	1.44	1.16	0.94	0.86	0.81
0	4.41	2.96	2.33	1.93	1.64	1.26	1.09	1.07	0.94	0.76
5	4.48	3.03	2.33	1.99	1.64	1.45	1.12	1.07	0.82	0.83
10	4.52	2.89	2.44	1.86	1.61	1.47	1.09	1.01	0.76	0.82
15	4.46	2.87	2.32	2.00	1.65	1.41	1.10	1.13	0.93	0.89
20	4.53	3.01	2.35	1.97	1.63	1.36	1.27	0.99	0.85	0.71
25	4.44	2.84	2.29	1.94	1.59	1.41	1.25	1.15	0.88	0.88
30	4.41	2.98	2.24	1.75	1.60	1.36	1.15	0.95	0.75	0.79
35	4.52	2.93	2.23	1.96	1.56	1.30	1.24	0.99	0.91	0.88
40	4.55	3.00	2.35	1.96	1.60	1.51	1.13	1.04	0.90	0.68
45	4.24	2.80	2.32	1.86	1.62	1.42	1.26	0.96	1.02	0.91
50	4.33	2.95	2.29	1.91	1.50	1.31	1.12	1.01	0.90	0.92
55	4.44	3.04	2.31	1.90	1.62	1.45	1.21	1.04	0.90	0.78
60	4.37	2.94	2.27	1.95	1.62	1.40	1.11	0.93	0.82	0.76
65	4.42	2.79	2.31	1.90	1.70	1.44	1.27	1.13	1.02	0.82
70	4.47	2.93	2.36	1.85	1.67	1.35	1.08	1.02	0.92	0.85
75	4.50	2.89	2.30	1.94	1.57	1.38	1.26	1.00	0.88	0.82
80	4.42	3.06	2.37	1.90	1.52	1.33	1.22	0.94	0.86	0.83
85	4.50	2.95	2.19	2.02	1.54	1.37	1.19	0.96	0.95	0.86
90	4.53	2.98	2.36	1.90	1.50	1.29	1.15	1.00	0.96	0.79

Table B3. Reliability (average standard deviation) for M-UP-3; i.e., three congiuent out of last five (majority rule with updates), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.36	2.99	2.37	1.95	1.55	1.40	1.32	0.91	0.87	0.82
-5	4.44	2.86	2.25	1.95	1.62	1.35	1.28	1.02	0.86	0.83
0	4.46	2.99	2.24	1.79	1.58	1.30	1.17	0.85	0.99	0.82
5	4.48	2.90	2.30	1.87	1.70	1.58	1.24	1.07	0.93	0.86
10	4.53	2.84	2.21	1.90	1.67	1.26	1.20	0.98	0.90	0.73
15	4.42	2.98	2.39	1.84	1.59	1.44	1.24	0.97	0.91	0.92
20	4.57	3.02	2.35	1.91	1.47	1.41	1.14	1.00	0.96	0.85
25	4.44	2.88	2.36	1.84	1.53	1.33	1.19	1.01	0.92	0.75
30	4.36	2.94	2.29	1.82	1.62	1.34	1.10	0.98	0.97	0.82
35	4.29	2.92	2.38	1.92	1.80	1.36	1.23	1.00	0.90	0.92
40	4.55	3.04	2.31	1.91	1.50	1.43	1.14	1.10	0.87	0.83
45	4.20	2.85	2.28	1.93	1.61	1.47	1.21	0.98	0.89	0.88
50	4.33	2.94	2.33	1.91	1.63	1.37	1.24	1.06	0.85	0.83
55	4.34	2.87	2.29	2.01	1.61	1.41	1.25	1.13	0.92	0.84
60	4.50	2.85	2.30	1.89	1.64	1.25	1.18	1.04	0.93	0.76
65	4.50	2.77	2.29	1.87	1.71	1.36	1.20	1.13	0.90	0.91
70	4.43	3.04	2.34	2.02	1.61	1.24	1.32	1.06	0.93	0.74
75	4.41	2.97	2.43	1.95	1.64	1.46	1.22	1.05	0.92	0.90
80	4.28	2.87	2.21	1.84	1.63	1.31	1.15	0.95	0.99	0.79
85	4.32	3.00	2.28	1.92	1.70	1.46	1.23	1.21	0.86	0.81
90	4.41	2.96	2.26	1.87	1.55	1.19	1.25	0.97	0.87	0.77

Table B4. Reliability (average standard deviation) for H-MAX-3; i.e., three congruent with six ascent limit (half rule with limit on the number of ascents), no update.

-10	4.44	2.91	2.34	1.87	1.65	1.37	1.19	0.96	0.91	0.78
-5	4.34	2.73	2.29	1.92	1.60	1.42	1.20	0.98	0.91	0.88
0	4.39	2.84	2.31	1.88	1.52	1.41	1.12	0.90	0.86	0.79
5	4.33	2.88	2.27	1.89	1.60	1.28	1.23	1.13	0.91	1.02
10	4.34	2.83	2.19	1.83	1.71	1.40	1.15	1.02	0.87	0.70
15	4.37	2.85	2.24	1.84	1.64	1.27	1.27	1.06	0.93	0.85
20	4.18	2.82	2.21	1.91	1.63	1.39	1.13	1.05	0.91	0.79
25	4.18	2.78	2.31	1.91	1.63	1.44	1.17	1.06	0.93	0.83
30	4.43	2.84	2.22	1.96	1.57	1.44	1.10	0.86	0.81	0.81
35	4.41	2.88	2.29	1.80	1.64	1.45	1.15	1.03	0.93	0.82
40	4.20	2.91	2.30	1.85	1.53	1.35	1.01	1.02	0.82	0.90
45	4.11	2.81	2.28	1.90	1.58	1.44	1.14	1.00	0.94	0.87
50	4.56	2.83	2.30	1.92	1.55	1.41	1.09	0.96	0.89	0.83
55	4.38	2.69	2.39	1.89	1.67	1.36	1.17	1.14	0.96	0.80
60	4.37	2.96	2.17	1.82	1.61	1.35	1.25	0.89	0.86	0.88
65	4.45	2.79	2.29	1.88	1.59	1.28	1.23	1.03	0.95	0.90
70	4.45	2.99	2.24	1.88	1.65	1.20	1.15	0.86	0.85	0.83
75	4.33	2.91	2.27	1.92	1.58	1.31	1.18	1.11	0.98	0.86
80	4.36	2.94	2.10	1.88	1.66	1.17	1.10	0.91	0.89	0.77
85	4.37	2.87	2.25	1.82	1.48	1.38	1.28	1.03	0.89	0.90
90	4.31	2.89	2.28	1.93	1.63	1.27	1.11	0.87	0.92	0.81

Table B5. Average location of threshold for H-NO-3; i.e., three congruent with half rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.25	2.87	2.32	1.88	1.66	1.35	1.12	0.97	0.85	0.88
-5	4.27	2.81	2.39	1.92	1.71	1.30	1.17	1.01	1.00	0.87
0	4.05	3.03	2.29	1.92	1.66	1.37	1.21	0.97	0.86	0.65
5	4.40	2.88	2.23	1.96	1.43	1.29	1.17	1.02	0.87	0.84
10	4.18	2.91	2.25	1.97	1.63	1.35	1.23	1.07	0.99	0.86
15	4.18	2.92	2.25	2.02	1.66	1.50	1.09	0.99	0.85	0.81
20	4.23	2.93	2.33	1.90	1.74	1.46	1.22	0.88	0.92	0.80
25	4.02	2.75	2.28	1.99	1.73	1.39	1.13	1.10	0.88	0.79
30	4.36	2.80	2.22	1.93	1.45	1.29	1.17	0.91	0.84	0.81
35	4.42	2.92	2.33	1.93	1.59	1.54	1.25	1.17	1.00	0.95
40	4.26	2.88	2.39	1.76	1.58	1.26	1.16	1.00	0.81	0.85
45	4.10	2.76	2.08	1.88	1.60	1.47	1.14	1.01	0.90	0.98
50	4.20	2.97	2.28	1.79	1.57	1.30	1.08	1.07	0.89	0.74
55	4.19	2.76	2.25	1.85	1.61	1.31	1.20	1.02	0.94	0.90
60	4.41	2.93	2.35	1.97	1.58	1.40	1.10	0.98	0.91	0.82
65	4.22	2.88	2.30	1.90	1.69	1.32	1.23	1.05	0.88	0.85
70	4.13	2.87	2.32	1.83	1.53	1.32	1.11	0.96	0.92	0.74
75	4.29	2.90	2.22	1.91	1.57	1.27	1.20	0.95	0.93	0.88
80	4.17	2.93	2.28	2.01	1.52	1.42	1.08	0.99	0.90	0.79
85	4.35	2.80	2.36	1.84	1.57	1.37	1.21	1.04	0.97	0.77
90	4.26	2.80	2.25	1.86	1.52	1.27	1.23	1.01	0.94	0.79

Table B6. Reliability (average standard deviation) for M-MAX-3; i.e., three congruent with five ascent limit (majority rule with limit on the number of ascents), no update.

-10	4.52	2.92	2.21	1.81	1.55	1.38	1.20	0.92	0.87	0.84
-5	4.38	2.75	2.19	1.79	1.56	1.34	1.16	1.13	0.93	0.82
0	4.51	2.76	2.25	1.86	1.55	1.45	1.10	1.04	0.98	0.80
5	4.63	2.83	2.13	1.92	1.60	1.33	1.13	1.09	0.91	0.77
10	4.30	2.88	2.14	1.85	1.58	1.38	1.19	1.09	0.83	0.85
15	4.29	2.78	2.27	1.94	1.58	1.40	1.15	1.01	0.90	0.81
20	4.17	2.81	2.22	1.74	1.50	1.21	1.11	0.99	0.95	0.86
25	4.13	2.66	2.26	1.96	1.65	1.38	1.24	1.06	0.91	0.83
30	4.36	2.83	2.14	1.79	1.49	1.36	1.17	0.99	0.85	0.81
35	4.39	2.83	2.14	1.86	1.65	1.41	1.20	1.10	0.98	0.79
40	4.37	2.93	2.16	1.85	1.47	1.36	1.10	0.99	0.89	0.82
45	4.17	2.69	2.19	1.77	1.56	1.45	1.16	1.18	0.97	0.84
50	4.31	2.74	2.21	1.74	1.49	1.42	1.00	0.89	0.90	0.83
55	4.29	2.84	2.17	1.95	1.54	1.38	1.11	0.95	0.90	0.80
60	4.34	2.87	2.26	1.90	1.49	1.23	1.11	0.95	0.98	0.79
65	4.18	2.69	2.20	1.81	1.57	1.23	1.19	1.10	0.99	0.81
70	4.29	2.82	2.15	1.85	1.62	1.42	1.11	1.00	0.84	0.79
75	4.37	2.73	2.17	2.00	1.65	1.45	1.26	0.97	0.93	0.90
80	4.31	2.88	2.32	1.83	1.58	1.38	1.16	1.02	0.88	0.84
85	4.17	2.79	2.19	1.95	1.60	1.53	1.16	0.99	0.90	0.81
90	4.27	2.80	2.23	1.78	1.58	1.25	1.21	0.96	0.92	0.80

Table B7. Reliability (average standard deviation) for M-NO-3; i.e., three congruent with majority rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.35	2.77	2.11	1.77	1.54	1.40	1.23	0.94	0.87	0.85
-5	4.20	2.73	2.23	1.83	1.53	1.33	1.15	1.11	0.88	0.83
0	4.39	2.77	2.18	1.87	1.56	1.33	1.10	0.98	0.92	0.77
5	4.15	2.80	2.18	1.83	1.62	1.36	1.21	0.94	0.86	0.81
10	4.10	2.75	2.24	1.89	1.53	1.29	1.18	1.03	0.86	0.83
15	4.21	2.75	2.24	1.79	1.57	1.37	1.28	0.99	0.90	0.91
20	4.19	2.79	2.24	1.88	1.56	1.35	1.18	1.05	0.86	0.80
25	4.13	2.74	2.21	1.87	1.61	1.32	1.21	1.11	0.86	0.85
30	4.16	2.73	2.25	1.69	1.54	1.12	1.26	0.92	0.88	0.73
35	4.15	2.75	2.16	1.77	1.53	1.32	1.30	0.97	0.97	0.83
40	4.19	2.76	2.20	1.72	1.61	1.29	1.18	1.13	0.78	0.81
45	3.85	2.61	2.06	1.88	1.65	1.36	1.26	0.97	0.90	0.83
50	4.18	2.66	2.11	1.85	1.62	1.36	0.99	1.07	0.89	0.78
55	3.86	2.66	2.19	1.80	1.65	1.25	1.14	1.00	0.91	0.85
60	4.35	2.75	2.18	1.85	1.55	1.36	1.18	1.04	0.91	0.77
65	3.95	2.67	2.20	1.92	1.62	1.55	1.22	1.02	0.93	0.95
70	4.15	2.76	2.14	1.88	1.50	1.32	1.13	0.98	0.80	0.79
75	4.27	2.57	2.15	1.78	1.63	1.35	1.07	1.03	0.92	0.88
80	4.31	2.78	2.19	1.79	1.59	1.37	1.22	0.94	0.96	0.78
85	4.00	2.68	2.23	1.80	1.69	1.32	1.13	0.99	0.94	0.78
90	4.28	2.68	2.10	1.80	1.59	1.30	1.12	1.10	0.80	0.78

Table B8. Reliability (average standard deviation) for A-NO-2; i.e., first two congruent with no percent rule, no limit on number of ascents, no update.

-10	5.33	3.37	2.53	2.17	1.92	1.63	1.47	1.34	1.17	0.97
-5	5.19	3.31	2.56	2.19	1.94	1.61	1.49	1.39	1.09	1.11
0	5.38	3.33	2.54	2.09	1.84	1.63	1.51	1.21	0.96	0.98
5	5.11	3.40	2.70	2.23	1.86	1.65	1.35	1.31	1.08	1.16
10	5.33	3.33	2.55	2.12	1.84	1.51	1.44	1.35	1.07	1.00
15	5.18	3.39	2.57	2.23	1.95	1.66	1.32	1.32	1.15	1.04
20	5.15	3.36	2.61	2.24	1.75	1.60	1.28	1.29	1.04	1.05
25	4.77	3.22	2.58	2.16	1.91	1.68	1.45	1.25	1.14	1.02
30	5.31	3.30	2.64	2.18	1.87	1.64	1.44	1.30	1.02	0.93
35	5.32	3.36	2.60	2.19	1.94	1.57	1.41	1.41	1.09	1.07
40	5.27	3.42	2.50	2.12	1.83	1.64	1.46	1.17	1.16	0.98
45	4.93	3.42	2.54	2.20	1.81	1.65	1.56	1.34	1.27	1.00
50	4.95	3.23	2.66	2.20	1.78	1.54	1.42	1.22	1.13	1.03
55	5.11	3.18	2.61	2.06	1.89	1.70	1.39	1.21	1.14	1.03
60	5.23	3.39	2.61	2.12	1.86	1.64	1.43	1.15	1.09	0.90
65	5.05	3.08	2.61	2.05	1.93	1.65	1.69	1.28	1.25	1.08
70	5.06	3.29	2.53	2.10	1.85	1.64	1.41	1.24	1.07	0.99
75	4.97	3.26	2.60	2.23	1.90	1.72	1.52	1.35	1.15	1.01
80	5.27	3.38	2.60	2.16	1.95	1.60	1.23	1.17	1.03	0.97
85	5.16	3.28	2.61	2.18	1.89	1.72	1.45	1.27	1.02	1.02
90	5.19	3.27	2.57	2.18	1.80	1.66	1.44	1.19	1.01	0.99

Table B9. Reliability (average standard deviation) for H-UP-2; i.e., two congruent out of last four (half rule with updates), no limit on number of ascents.

dB HL	SLOPES 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	5.30	3.40	2.64	2.21	1.76	1.56	1.43	1.31	1.10	1.03
-5	5.18	3.25	2.61	2.15	1.87	1.72	1.41	1.32	1.12	1.09
0	5.45	3.45	2.64	2.10	1.80	1.61	1.46	1.15	1.10	1.08
5	5.14	3.36	2.59	2.22	1.82	1.71	1.52	1.27	1.02	1.06
10	5.35	3.26	2.60	2.19	1.83	1.55	1.36	1.15	1.14	1.05
15	5.22	3.29	2.57	2.06	1.86	1.69	1.39	1.28	1.10	1.00
20	5.11	3.23	2.61	2.17	1.82	1.68	1.50	1.09	1.14	0.96
25	4.74	3.31	2.52	2.08	1.89	1.70	1.55	1.25	1.17	0.98
30	5.10	3.31	2.52	2.07	1.83	1.61	1.39	1.30	1.07	0.94
35	5.25	3.36	2.58	2.15	1.98	1.63	1.49	1.24	1.08	1.12
40	5.24	3.38	2.55	2.15	1.87	1.62	1.37	1.29	1.24	0.94
45	5.21	3.27	2.55	2.28	1.82	1.63	1.47	1.26	1.10	1.10
50	5.20	3.36	2.59	2.07	1.89	1.45	1.31	1.19	1.01	1.02
55	5.24	3.18	2.51	2.18	1.91	1.67	1.51	1.39	1.15	1.06
60	4.88	3.38	2.61	2.12	1.81	1.68	1.37	1.15	1.18	1.02
65	5.09	3.25	2.66	2.12	2.02	1.60	1.45	1.40	1.30	1.12
70	5.09	3.35	2.55	2.07	1.83	1.64	1.42	1.33	1.01	0.97
75	4.96	3.26	2.56	2.12	1.87	1.71	1.47	1.37	1.19	0.98
80	5.20	3.40	2.53	2.07	1.86	1.58	1.41	1.13	0.95	0.85
85	4.99	3.25	2.62	2.13	1.89	1.65	1.52	1.28	1.24	1.13
90	4.80	3.28	2.68	2.19	1.92	1.60	1.42	1.15	1.07	1.06

Table B10. Reliability (average standard deviation) for M-UP-2; i.e., two congruent out of last three (majority rule with updates), no limit on number of ascents.

-10	5.28	3.27	2.63	2.18	1.85	1.70	1.40	1.34	1.10	1.03
-5	5.29	3.39	2.55	2.23	1.93	1.72	1.49	1.46	1.01	1.04
0	5.24	3.24	2.59	2.10	1.83	1.73	1.41	1.28	1.07	0.95
5	4.95	3.37	2.51	2.14	1.92	1.56	1.53	1.35	0.97	0.96
10	5.43	3.25	2.58	2.19	1.81	1.63	1.36	1.30	1.08	0.97
15	5.10	3.47	2.64	2.10	1.95	1.72	1.58	1.25	1.14	1.05
20	5.12	3.43	2.67	2.12	1.84	1.53	1.42	1.28	1.22	1.01
25	5.03	3.26	2.57	2.13	1.76	1.58	1.57	1.28	1.10	1.07
30	5.18	3.44	2.55	2.15	1.80	1.60	1.38	1.26	1.00	0.87
35	5.20	3.36	2.57	2.24	1.86	1.70	1.52	1.42	1.11	1.01
40	5.22	3.23	2.56	2.17	1.93	1.66	1.38	1.21	1.08	1.04
45	5.17	3.20	2.67	2.14	1.89	1.63	1.61	1.40	1.22	0.95
50	5.15	3.29	2.63	2.17	1.85	1.57	1.43	1.27	1.02	0.90
55	4.96	3.32	2.57	2.08	1.90	1.69	1.51	1.35	1.05	1.18
60	5.15	3.32	2.65	2.14	1.87	1.46	1.31	1.16	1.07	0.95
65	5.13	3.21	2.63	2.24	1.95	1.65	1.52	1.38	1.25	1.10
70	5.03	3.32	2.69	2.16	1.84	1.61	1.31	1.27	0.98	0.98
75	4.95	3.26	2.58	2.13	1.89	1.57	1.47	1.34	1.20	1.11
80	4.99	3.38	2.58	2.14	1.83	1.58	1.41	1.32	1.05	0.97
85	4.89	3.16	2.60	2.18	1.90	1.74	1.49	1.40	1.25	0.98
90	5.00	3.34	2.63	2.19	1.87	1.58	1.29	1.05	1.06	1.02

Table B11. Reliability (average standard deviation) for H-MAX-2; i.e., two congruent with four as cent limit (half rule with limit on the number of ascents), no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	5.21	3.25	2.58	2.22	1.82	1.65	1.34	1.28	1.11	0.90
-5	5.25	3.40	2.59	2.21	1.90	1.71	1.45	1.29	1.00	1.06
0	5.33	3.27	2.59	2.13	1.85	1.59	1.36	1.31	1.14	1.03
5	5.41	3.28	2.59	2.14	1.79	1.61	1.53	1.36	1.22	0.97
10	5.37	3.22	2.50	2.13	1.83	1.61	1.52	1.26	1.30	1.00
15	5.16	3.44	2.60	2.20	1.91	1.66	1.42	1.21	1.21	0.97
20	4.83	3.34	2.53	2.13	1.94	1.69	1.30	1.18	1.06	0.96
25	4.77	3.24	2.46	2.16	1.93	1.64	1.37	1.31	1.16	1.02
30	5.14	3.43	2.60	2.20	1.77	1.54	1.32	1.08	0.94	0.97
35	5.14	3.49	2.65	2.13	1.88	1.76	1.60	1.43	1.06	1.03
40	5.01	3.43	2.42	2.13	1.94	1.51	1.42	1.28	0.96	1.03
45	4.85	3.01	2.48	2.14	1.80	1.60	1.53	1.33	1.13	1.03
50	4.93	3.39	2.51	2.12	1.79	1.65	1.29	1.05	1.07	0.90
55	5.01	3.29	2.64	2.03	1.93	1.67	1.47	1.29	1.15	1.02
60	5.15	3.26	2.57	2.08	1.90	1.65	1.41	1.25	1.02	0.94
65	5.14	3.30	2.61	2.19	1.80	1.59	1.49	1.29	1.16	1.01
70	4.91	3.39	2.61	2.22	1.86	1.59	1.44	1.23	1.08	0.90
75	4.87	3.28	2.63	2.04	1.92	1.54	1.46	1.24	1.13	1.20
80	4.92	3.28	2.59	2.08	1.81	1.62	1.45	1.26	1.22	0.99
85	4.99	3.18	2.49	2.18	1.90	1.65	1.52	1.31	1.33	1.10
90	4.98	3.30	2.65	2.17	1.83	1.57	1.36	1.27	1.04	1.02

Table B12. Reliability (average standard deviation) for H-NO-2; i.e., two congruent with half rule, no limit on number of ascents, no update.

-10	5.25	3.33	2.57	2.17	1.80	1.61	1.37	1.32	1.06	0.96
-5	5.32	3.27	2.60	2.19	1.87	1.76	1.55	1.31	1.23	0.96
0	5.10	3.41	2.62	2.17	1.87	1.66	1.38	1.16	0.94	0.95
5	5.19	3.33	2.65	2.19	1.86	1.76	1.43	1.26	1.11	1.00
10	5.21	3.26	2.55	2.15	1.86	1.59	1.34	1.12	1.12	1.04
15	5.02	3.21	2.51	2.25	1.89	1.66	1.45	1.30	1.28	1.01
20	5.09	3.26	2.57	2.12	1.84	1.48	1.38	1.22	1.08	0.97
25	4.85	3.20	2.52	2.17	1.84	1.59	1.45	1.28	1.16	1.04
30	4.89	3.24	2.63	2.12	1.87	1.56	1.44	1.20	1.07	1.06
35	5.30	3.28	2.61	2.14	1.91	1.67	1.49	1.27	1.23	1.04
40	5.13	3.36	2.64	2.09	1.96	1.54	1.39	1.22	1.15	0.97
45	4.88	3.16	2.52	2.14	1.95	1.71	1.50	1.29	1.18	0.95
50	4.97	3.28	2.68	2.09	1.86	1.61	1.38	1.33	1.08	0.98
55	5.07	3.20	2.54	2.10	1.80	1.63	1.48	1.29	1.13	0.95
60	5.12	3.29	2.54	2.18	1.87	1.64	1.28	1.26	1.15	0.91
65	4.89	3.17	2.54	2.15	1.87	1.68	1.40	1.22	1.20	1.07
70	5.00	3.34	2.62	2.11	1.73	1.56	1.35	1.27	0.96	0.98
75	4.99	3.20	2.51	2.16	1.96	1.67	1.48	1.26	1.11	1.14
80	4.92	3.50	2.67	2.24	1.80	1.69	1.35	1.19	1.00	0.98
85	5.13	3.23	2.54	2.22	1.98	1.66	1.69	1.34	1.21	1.01
90	4.93	3.37	2.57	2.16	1.66	1.59	1.47	1.21	1.09	0.96

Table B13. Reliability (average standard deviation) for M-MAX-2; i.e., two congruent with three ascent limit (majority rule with limit on the number of ascents), no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	5.51	3.20	2.41	2.12	1.80	1.62	1.34	1.19	1.18	1.00
-5	5.54	3.31	2.43	2.04	1.89	1.68	1.35	1.47	1.26	0.99
0	5.54	3.22	2.46	2.14	1.81	1.46	1.51	1.20	1.09	1.08
5	5.47	3.44	2.55	2.21	1.98	1.66	1.43	1.31	1.09	1.06
10	5.41	3.12	2.33	2.13	1.86	1.55	1.49	1.17	0.98	0.95
15	4.79	3.14	2.59	2.21	1.91	1.66	1.44	1.37	1.15	1.02
20	4.80	3.21	2.52	2.18	1.91	1.60	1.44	1.30	1.28	0.91
25	5.07	3.12	2.48	2.18	1.80	1.61	1.51	1.18	1.19	0.96
30	5.17	3.21	2.60	2.06	1.75	1.62	1.34	1.29	1.14	0.99
35	5.40	3.30	2.52	2.19	1.91	1.59	1.17	1.21	1.18	1.14
40	5.22	3.25	2.57	2.08	1.92	1.52	1.34	1.17	1.14	1.05
45	4.85	3.01	2.48	2.06	1.90	1.75	1.47	1.27	1.03	1.03
50	4.82	3.24	2.53	2.13	1.82	1.56	1.38	1.31	1.15	1.02
55	5.07	3.12	2.44	2.14	1.81	1.61	1.46	1.43	1.25	0.98
60	4.87	3.20	2.55	2.16	1.83	1.65	1.38	1.14	1.07	0.96
65	4.99	3.03	2.44	2.08	1.88	1.68	1.40	1.33	1.07	1.00
70	4.97	3.31	2.57	2.16	1.76	1.57	1.31	1.25	0.98	0.94
75	4.90	3.11	2.56	2.17	1.93	1.67	1.60	1.32	1.18	0.99
80	5.06	3.35	2.39	2.13	1.87	1.52	1.27	1.16	1.02	0.93
85	5.02	3.26	2.53	2.20	1.88	1.69	1.47	1.20	1.12	0.98
90	5.10	3.32	2.50	2.17	1.86	1.65	1.42	1.17	1.01	0.98

Table B14. Reliability (average standard deviation) for M-NO-2; i.e., two congruent with majority rule, no limit on number of ascents, no update.

-10	5.16	3.13	2.52	2.07	1.82	1.55	1.43	1.32	1.05	1.03
-5	5.14	3.15	2.53	2.09	1.87	1.63	1.48	1.33	1.19	1.06
0	4.93	3.12	2.49	2.04	1.73	1.54	1.39	1.25	1.17	0.95
5	5.03	3.19	2.53	2.23	1.81	1.69	1.44	1.36	1.31	1.05
10	5.20	3.18	2.47	2.14	1.80	1.61	1.44	1.18	1.20	0.92
15	4.90	3.13	2.56	2.12	1.79	1.61	1.47	1.23	1.10	1.01
20	4.89	3.18	2.50	2.04	1.75	1.59	1.47	1.25	1.22	0.92
25	4.77	3.11	2.41	2.09	1.83	1.72	1.46	1.31	1.26	1.05
30	5.02	3.18	2.46	2.05	1.72	1.50	1.40	1.15	1.09	1.01
35	5.16	3.26	2.52	2.12	1.93	1.65	1.43	1.37	1.10	0.97
40	4.87	3.23	2.48	2.12	1.80	1.50	1.49	1.26	1.04	0.94
45	4.67	3.02	2.46	2.15	1.88	1.55	1.51	1.19	1.15	1.07
50	4.98	3.16	2.35	2.08	1.82	1.60	1.35	1.22	0.94	0.93
55	4.93	3.07	2.52	2.06	1.82	1.66	1.53	1.40	1.16	0.96
60	4.66	3.26	2.45	2.10	1.78	1.52	1.44	1.28	1.13	1.08
65	4.72	3.10	2.36	2.15	1.93	1.69	1.43	1.28	1.15	0.97
70	4.93	3.30	2.35	2.06	1.78	1.47	1.35	1.33	1.07	0.96
75	5.00	3.06	2.48	2.09	1.82	1.68	1.48	1.24	1.24	1.01
80	4.90	3.13	2.45	2.11	1.83	1.62	1.40	1.06	1.04	0.97
85	4.81	3.17	2.41	2.05	1.91	1.58	1.50	1.28	1.02	1.06
90	4.96	3.13	2.50	2.15	1.79	1.54	1.37	1.24	1.06	0.95

Appendix C. Average Consistency of Threshold Estimates in dB

Table C1. Consistency for A-NO-3; i.e., first three congruent with no percent rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.55	2.99	2.31	1.93	1.80	1.73	1.61	1.57	1.53	1.55
-5	4.47	2.92	2.34	2.04	1.79	1.74	1.63	1.60	1.53	1.55
0	4.60	2.99	2.35	1.95	1.81	1.68	1.61	1.58	1.53	1.53
5	4.45	2.86	2.34	2.04	1.81	1.69	1.66	1.62	1.58	1.53
10	4.66	2.94	2.30	1.88	1.80	1.66	1.63	1.57	1.57	1.53
15	4.50	3.06	2.35	1.91	1.84	1.66	1.62	1.61	1.54	1.53
20	4.49	3.10	2.29	1.99	1.77	1.63	1.60	1.57	1.57	1.53
25	4.48	2.87	2.37	1.93	1.77	1.69	1.63	1.57	1.57	1.52
30	4.46	3.05	2.34	1.98	1.80	1.66	1.60	1.56	1.58	1.53
35	4.74	3.04	2.38	2.02	1.85	1.69	1.61	1.61	1.57	1.52
40	4.56	3.01	2.30	2.05	1.81	1.70	1.63	1.56	1.53	1.53
45	4.48	2.91	2.35	2.00	1.79	1.71	1.63	1.62	1.54	1.54
50	4.45	3.02	2.34	1.99	1.79	1.68	1.61	1.59	1.59	1.53
55	4.31	2.93	2.40	1.97	1.79	1.65	1.63	1.59	1.55	1.55
60	4.47	2.99	2.34	1.97	1.85	1.66	1.60	1.58	1.53	1.54
65	4.13	2.96	2.34	1.95	1.76	1.73	1.65	1.59	1.54	1.55
70	4.46	2.94	2.31	2.00	1.78	1.66	1.63	1.59	1.54	1.52
75	4.69	2.99	2.43	2.00	1.79	1.73	1.64	1.62	1.55	1.53
80	4.46	2.94	2.33	1.96	1.79	1.68	1.62	1.58	1.55	1.52
85	4.49	2.83	2.36	1.97	1.83	1.72	1.62	1.58	1.55	1.52
90	4.51	2.90	2.36	1.97	1.74	1.68	1.62	1.58	1.56	1.53

Table C2. Consistency for H-UP-3; i.e., three congruent out of last six (half rule with updates), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.42	3.11	2.30	1.98	1.79	1.64	1.65	1.58	1.55	1.56
-5	4.57	2.90	2.27	1.93	1.82	1.71	1.62	1.57	1.55	1.53
0	4.43	2.96	2.35	2.00	1.81	1.66	1.63	1.59	1.57	1.53
5	4.50	3.04	2.34	2.04	1.81	1.71	1.61	1.59	1.54	1.54
10	4.53	2.90	2.46	1.95	1.79	1.73	1.62	1.57	1.52	1.54
15	4.47	2.87	2.34	2.05	1.81	1.70	1.63	1.61	1.57	1.55
20	4.55	3.03	2.37	2.03	1.81	1.68	1.65	1.58	1.54	1.51
25	4.45	2.84	2.32	2.01	1.77	1.70	1.66	1.60	1.55	1.55
30	4.41	2.99	2.27	1.89	1.78	1.68	1.63	1.57	1.52	1.53
35	4.53	2.95	2.26	2.01	1.77	1.65	1.66	1.58	1.56	1.55
40	4.56	3.03	2.36	2.02	1.79	1.74	1.61	1.60	1.54	1.52
45	4.25	2.81	2.33	1.95	1.81	1.72	1.64	1.57	1.57	1.56
50	4.34	2.96	2.31	1.97	1.74	1.65	1.64	1.59	1.55	1.56
55	4.46	3.05	2.32	1.98	1.79	1.73	1.62	1.58	1.56	1.53
60	4.39	2.96	2.28	2.01	1.80	1.69	1.61	1.57	1.53	1.52
65	4.44	2.79	2.33	1.99	1.85	1.71	1.64	1.61	1.57	1.54
70	4.49	2.94	2.37	1.94	1.82	1.70	1.60	1.58	1.55	1.54
75	4.53	2.90	2.32	2.00	1.78	1.69	1.65	1.57	1.55	1.54
80	4.44	3.07	2.39	1.98	1.75	1.66	1.63	1.57	1.54	1.54
85	4.50	2.96	2.22	2.06	1.77	1.69	1.64	1.57	1.56	1.55
90	4.53	2.98	2.37	1.97	1.74	1.66	1.62	1.59	1.56	1.53

Table C3. Consistency for M-UP-3; i.e., three congruent out of last five (majority rule with updates), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.37	3.00	2.39	2.02	1.77	1.70	1.66	1.56	1.55	1.54
-5	4.45	2.88	2.27	2.02	1.80	1.69	1.66	1.60	1.54	1.54
0	4.47	3.01	2.28	1.90	1.77	1.66	1.63	1.55	1.57	1.53
5	4.49	2.91	2.32	1.94	1.84	1.77	1.63	1.59	1.56	1.55
10	4.54	2.85	2.27	1.97	1.82	1.65	1.64	1.58	1.55	1.52
15	4.43	3.00	2.40	1.93	1.78	1.72	1.63	1.58	1.56	1.56
20	4.59	3.04	2.36	1.98	1.72	1.69	1.61	1.59	1.57	1.54
25	4.45	2.88	2.37	1.93	1.78	1.69	1.64	1.59	1.56	1.52
30	4.39	2.95	2.30	1.93	1.80	1.67	1.61	1.58	1.56	1.53
35	4.30	2.92	2.39	1.99	1.90	1.69	1.63	1.59	1.56	1.56
40	4.56	3.05	2.33	2.00	1.75	1.71	1.63	1.63	1.55	1.54
45	4.21	2.86	2.30	2.00	1.79	1.72	1.64	1.58	1.55	1.55
50	4.34	2.94	2.33	1.99	1.80	1.69	1.64	1.59	1.54	1.54
55	4.35	2.87	2.31	2.05	1.80	1.70	1.64	1.60	1.56	1.54
60	4.50	2.86	2.31	1.97	1.81	1.64	1.64	1.58	1.57	1.52
65	4.52	2.79	2.31	1.97	1.85	1.68	1.64	1.61	1.56	1.56
70	4.45	3.05	2.36	2.06	1.80	1.66	1.66	1.59	1.56	1.52
75	4.43	2.97	2.44	2.02	1.82	1.72	1.62	1.61	1.56	1.56
80	4.30	2.88	2.23	1.93	1.80	1.66	1.62	1.57	1.57	1.53
85	4.35	3.00	2.30	1.98	1.84	1.73	1.63	1.62	1.55	1.53
90	4.43	2.96	2.28	1.96	1.78	1.64	1.63	1.58	1.55	1.53

Table C4. Consistency for H-MAX-3; i.e., three congruent with six ascent limit (half rule with limit on the number of ascents), no update.

-10	4.46	2.93	2.36	1.95	1.82	1.70	1.62	1.58	1.56	1.52
-5	4.34	2.73	2.31	1.98	1.80	1.71	1.62	1.58	1.56	1.54
0	4.40	2.85	2.33	1.96	1.75	1.71	1.61	1.55	1.55	1.53
5	4.35	2.88	2.29	1.97	1.79	1.65	1.64	1.62	1.56	1.58
10	4.36	2.85	2.22	1.95	1.86	1.70	1.62	1.58	1.55	1.51
15	4.38	2.86	2.26	1.92	1.81	1.66	1.66	1.59	1.56	1.54
20	4.19	2.83	2.23	1.98	1.82	1.71	1.62	1.61	1.55	1.53
25	4.20	2.78	2.33	1.97	1.80	1.71	1.63	1.59	1.56	1.54
30	4.45	2.84	2.24	2.02	1.77	1.72	1.61	1.54	1.53	1.53
35	4.42	2.90	2.31	1.90	1.80	1.73	1.62	1.60	1.57	1.54
40	4.21	2.92	2.33	1.94	1.81	1.67	1.59	1.60	1.54	1.55
45	4.12	2.84	2.29	1.98	1.78	1.70	1.62	1.59	1.57	1.55
50	4.57	2.84	2.32	1.99	1.77	1.70	1.60	1.57	1.55	1.53
55	4.39	2.70	2.40	1.96	1.83	1.70	1.61	1.62	1.57	1.53
60	4.39	2.97	2.21	1.92	1.79	1.69	1.64	1.55	1.55	1.55
65	4.46	2.79	2.31	1.97	1.78	1.65	1.64	1.60	1.57	1.56
70	4.46	3.02	2.26	1.96	1.81	1.68	1.62	1.54	1.54	1.54
75	4.34	2.91	2.28	1.99	1.79	1.66	1.64	1.59	1.56	1.55
80	4.37	2.94	2.14	1.97	1.82	1.63	1.61	1.56	1.55	1.52
85	4.38	2.88	2.27	1.92	1.72	1.69	1.65	1.60	1.55	1.56
90	4.32	2.90	2.30	2.00	1.80	1.67	1.59	1.56	1.56	1.53

Table C5. Consistency for H-NO-3; i.e., three congruent with half rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.27	2.89	2.35	1.98	1.83	1.71	1.62	1.58	1.54	1.55
-5	4.28	2.81	2.41	1.99	1.85	1.68	1.63	1.59	1.59	1.55
0	4.05	3.05	2.31	1.99	1.83	1.69	1.62	1.58	1.54	1.50
5	4.43	2.89	2.26	2.03	1.73	1.68	1.63	1.59	1.55	1.54
10	4.20	2.92	2.29	2.03	1.80	1.68	1.63	1.60	1.56	1.54
15	4.19	2.92	2.27	2.06	1.82	1.76	1.62	1.58	1.54	1.53
20	4.25	2.94	2.35	1.98	1.86	1.72	1.65	1.56	1.54	1.53
25	4.03	2.76	2.30	2.03	1.86	1.68	1.61	1.60	1.55	1.53
30	4.36	2.81	2.25	2.00	1.72	1.66	1.61	1.56	1.54	1.53
35	4.43	2.92	2.34	2.00	1.79	1.75	1.64	1.61	1.59	1.56
40	4.28	2.89	2.41	1.88	1.77	1.66	1.63	1.57	1.53	1.55
45	4.11	2.77	2.12	1.96	1.79	1.72	1.65	1.60	1.56	1.56
50	4.21	2.98	2.30	1.92	1.78	1.66	1.59	1.59	1.55	1.52
55	4.20	2.77	2.27	1.94	1.80	1.68	1.62	1.60	1.57	1.56
60	4.42	2.95	2.37	2.03	1.79	1.69	1.60	1.58	1.54	1.54
65	4.23	2.89	2.31	1.99	1.84	1.66	1.64	1.57	1.55	1.54
70	4.13	2.88	2.33	1.93	1.76	1.67	1.61	1.57	1.56	1.52
75	4.32	2.91	2.23	1.99	1.77	1.67	1.64	1.57	1.56	1.55
80	4.19	2.94	2.30	2.05	1.75	1.70	1.62	1.58	1.55	1.53
85	4.35	2.81	2.37	1.93	1.77	1.69	1.64	1.60	1.58	1.53
90	4.27	2.81	2.27	1.94	1.75	1.67	1.63	1.59	1.56	1.53

Table C6. Consistency for M-MAX-3; i.e., three congruent with five ascent limit (majority rule with limit on the number of ascents), no update.

-10	4.54	2.94	2.24	1.93	1.76	1.69	1.62	1.56	1.55	1.54
-5	4.39	2.77	2.22	1.90	1.77	1.68	1.62	1.62	1.56	1.54
0	4.52	2.77	2.28	1.97	1.77	1.72	1.61	1.58	1.56	1.53
5	4.66	2.85	2.17	1.99	1.78	1.68	1.61	1.60	1.56	1.53
10	4.32	2.90	2.18	1.93	1.78	1.69	1.64	1.60	1.53	1.54
15	4.31	2.80	2.28	2.00	1.78	1.69	1.63	1.57	1.56	1.53
20	4.19	2.83	2.25	1.86	1.74	1.64	1.61	1.58	1.57	1.54
25	4.14	2.67	2.27	2.01	1.81	1.69	1.63	1.59	1.56	1.54
30	4.38	2.84	2.17	1.91	1.74	1.70	1.63	1.57	1.54	1.53
35	4.41	2.84	2.18	1.95	1.82	1.71	1.65	1.61	1.58	1.53
40	4.38	2.94	2.19	1.94	1.73	1.68	1.63	1.56	1.55	1.53
45	4.19	2.70	2.21	1.88	1.80	1.71	1.63	1.61	1.58	1.54
50	4.32	2.75	2.23	1.86	1.74	1.71	1.59	1.55	1.55	1.54
55	4.30	2.84	2.19	2.00	1.78	1.68	1.63	1.57	1.55	1.54
60	4.36	2.88	2.28	1.97	1.74	1.65	1.61	1.57	1.55	1.53
65	4.20	2.70	2.22	1.90	1.77	1.66	1.62	1.61	1.58	1.53
70	4.30	2.83	2.17	1.94	1.81	1.70	1.61	1.59	1.54	1.53
75	4.39	2.74	2.20	2.05	1.83	1.72	1.64	1.58	1.56	1.55
80	4.34	2.89	2.34	1.93	1.78	1.69	1.62	1.60	1.55	1.54
85	4.18	2.79	2.21	2.03	1.79	1.75	1.63	1.58	1.55	1.53
90	4.27	2.81	2.25	1.89	1.78	1.64	1.62	1.58	1.56	1.54

Table C7. Consistency for M-NO-3; i.e., three congruent with majority rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.37	2.78	2.15	1.90	1.78	1.71	1.62	1.57	1.55	1.54
-5	4.21	2.74	2.24	1.92	1.76	1.67	1.65	1.59	1.55	1.54
0	4.40	2.78	2.22	1.95	1.77	1.68	1.63	1.58	1.56	1.52
5	4.17	2.82	2.21	1.92	1.80	1.67	1.65	1.57	1.55	1.53
10	4.12	2.77	2.26	1.97	1.75	1.67	1.64	1.59	1.55	1.54
15	4.23	2.76	2.26	1.91	1.77	1.68	1.65	1.58	1.56	1.56
20	4.22	2.80	2.26	1.97	1.76	1.69	1.63	1.60	1.55	1.53
25	4.18	2.74	2.22	1.95	1.79	1.68	1.62	1.61	1.54	1.54
30	4.17	2.74	2.28	1.85	1.76	1.61	1.64	1.56	1.55	1.52
35	4.15	2.77	2.19	1.89	1.76	1.66	1.66	1.58	1.58	1.54
40	4.21	2.78	2.22	1.87	1.79	1.65	1.64	1.61	1.53	1.53
45	3.86	2.62	2.09	1.95	1.81	1.68	1.65	1.58	1.56	1.54
50	4.18	2.67	2.16	1.95	1.80	1.68	1.59	1.59	1.55	1.53
55	3.86	2.68	2.21	1.91	1.82	1.67	1.62	1.59	1.56	1.54
60	4.35	2.77	2.20	1.93	1.76	1.67	1.64	1.58	1.56	1.52
65	3.97	2.69	2.22	2.00	1.79	1.77	1.63	1.60	1.56	1.57
70	4.16	2.77	2.19	1.96	1.74	1.67	1.64	1.58	1.53	1.53
75	4.28	2.59	2.18	1.90	1.80	1.69	1.62	1.60	1.56	1.55
80	4.32	2.79	2.21	1.89	1.78	1.69	1.65	1.57	1.57	1.53
85	4.04	2.68	2.25	1.92	1.85	1.71	1.62	1.58	1.57	1.53
90	4.29	2.70	2.16	1.90	1.78	1.66	1.61	1.59	1.53	1.53

Table C8. Consistency for A-NO-2; i.e., first two congruent with no percent rule, no limit on number of ascents, no update.

-10	5.34	3.38	2.55	2.20	1.98	1.82	1.73	1.67	1.63	1.58
-5	5.21	3.32	2.60	2.23	2.00	1.79	1.74	1.70	1.60	1.61
0	5.40	3.35	2.55	2.13	1.93	1.80	1.75	1.65	1.58	1.58
5	5.12	3.42	2.71	2.25	1.95	1.82	1.71	1.66	1.62	1.60
10	5.34	3.35	2.57	2.16	1.94	1.74	1.72	1.67	1.59	1.57
15	5.20	3.40	2.58	2.25	2.01	1.82	1.68	1.66	1.62	1.58
20	5.16	3.37	2.64	2.26	1.87	1.79	1.66	1.67	1.60	1.59
25	4.78	3.24	2.60	2.19	1.98	1.82	1.72	1.65	1.62	1.59
30	5.31	3.31	2.67	2.22	1.96	1.81	1.72	1.66	1.58	1.56
35	5.34	3.39	2.61	2.21	2.01	1.79	1.70	1.70	1.62	1.57
40	5.28	3.43	2.52	2.17	1.92	1.82	1.72	1.64	1.60	1.56
45	4.95	3.42	2.55	2.22	1.91	1.82	1.77	1.68	1.67	1.59
50	4.98	3.24	2.68	2.22	1.89	1.75	1.71	1.65	1.60	1.58
55	5.13	3.19	2.62	2.09	1.96	1.84	1.70	1.65	1.62	1.60
60	5.26	3.40	2.63	2.16	1.95	1.82	1.72	1.62	1.60	1.56
65	5.06	3.09	2.62	2.10	1.99	1.82	1.83	1.67	1.63	1.59
70	5.07	3.30	2.54	2.14	1.95	1.80	1.71	1.67	1.59	1.57
75	4.98	3.27	2.62	2.25	1.98	1.85	1.76	1.68	1.62	1.59
80	5.29	3.40	2.60	2.20	2.01	1.79	1.65	1.63	1.60	1.57
85	5.18	3.29	2.62	2.20	1.96	1.86	1.71	1.66	1.60	1.59
90	5.21	3.28	2.59	2.20	1.90	1.82	1.71	1.64	1.59	1.59

Table C9. Consistency for H-UP-2; i.e., two congruent out of last four (half rule with updates), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	5.32	3.41	2.66	2.24	1.88	1.78	1.71	1.65	1.60	1.58
-5	5.19	3.25	2.62	2.17	1.96	1.88	1.69	1.67	1.61	1.60
0	5.46	3.45	2.67	2.14	1.92	1.80	1.73	1.62	1.60	1.60
5	5.16	3.36	2.62	2.24	1.91	1.84	1.76	1.65	1.59	1.61
10	5.36	3.27	2.62	2.22	1.94	1.77	1.68	1.61	1.62	1.59
15	5.23	3.30	2.58	2.12	1.94	1.83	1.70	1.66	1.61	1.59
20	5.12	3.25	2.63	2.20	1.92	1.83	1.73	1.60	1.61	1.57
25	4.76	3.32	2.54	2.11	1.96	1.85	1.77	1.66	1.64	1.58
30	5.11	3.31	2.53	2.11	1.94	1.80	1.69	1.66	1.59	1.57
35	5.27	3.38	2.58	2.17	2.04	1.81	1.75	1.67	1.62	1.61
40	5.25	3.39	2.57	2.18	1.95	1.79	1.69	1.69	1.66	1.57
45	5.22	3.28	2.56	2.29	1.92	1.81	1.73	1.64	1.61	1.61
50	5.22	3.37	2.62	2.12	2.00	1.71	1.67	1.64	1.57	1.57
55	5.25	3.19	2.52	2.19	1.99	1.84	1.74	1.70	1.62	1.59
60	4.89	3.39	2.62	2.16	1.92	1.84	1.68	1.62	1.61	1.57
65	5.11	3.27	2.67	2.14	2.06	1.80	1.72	1.71	1.66	1.62
70	5.10	3.36	2.56	2.11	1.92	1.81	1.70	1.66	1.59	1.58
75	4.97	3.27	2.58	2.14	1.95	1.85	1.73	1.69	1.64	1.58
80	5.21	3.40	2.56	2.10	1.95	1.78	1.70	1.61	1.57	1.54
85	5.01	3.26	2.63	2.16	1.97	1.84	1.74	1.66	1.63	1.60
90	4.83	3.30	2.69	2.22	1.99	1.81	1.70	1.63	1.60	1.59

Table C10. Consistency for M-UP-2; i.e., two congruent out of last three (majority rule with updates), no limit on number of ascents.

-10	5.30	3.29	2.64	2.20	1.94	1.84	1.70	1.67	1.63	1.58
-5	5.30	3.40	2.56	2.25	2.00	1.86	1.74	1.74	1.57	1.58
0	5.25	3.26	2.60	2.15	1.94	1.86	1.71	1.65	1.59	1.55
5	4.96	3.40	2.52	2.17	1.99	1.79	1.74	1.68	1.58	1.57
10	5.44	3.26	2.60	2.23	1.92	1.80	1.69	1.68	1.60	1.58
15	5.12	3.48	2.65	2.13	2.01	1.85	1.77	1.66	1.60	1.59
20	5.14	3.43	2.68	2.16	1.94	1.76	1.70	1.67	1.62	1.57
25	5.05	3.28	2.58	2.16	1.88	1.78	1.77	1.66	1.63	1.59
30	5.20	3.45	2.56	2.18	1.93	1.78	1.69	1.64	1.59	1.55
35	5.21	3.37	2.59	2.26	1.94	1.85	1.75	1.70	1.61	1.59
40	5.22	3.24	2.58	2.20	1.99	1.82	1.69	1.62	1.60	1.58
45	5.18	3.21	2.67	2.17	1.97	1.81	1.80	1.70	1.62	1.57
50	5.15	3.29	2.64	2.21	1.94	1.78	1.70	1.64	1.60	1.56
55	4.97	3.33	2.57	2.12	1.97	1.83	1.75	1.68	1.61	1.63
60	5.16	3.33	2.66	2.17	1.96	1.72	1.67	1.63	1.61	1.56
65	5.15	3.22	2.64	2.25	2.01	1.82	1.75	1.69	1.65	1.61
70	5.04	3.33	2.70	2.19	1.92	1.79	1.68	1.67	1.58	1.58
75	4.97	3.27	2.59	2.17	1.96	1.78	1.74	1.67	1.64	1.59
80	5.00	3.39	2.59	2.17	1.93	1.78	1.70	1.66	1.58	1.56
85	4.90	3.16	2.61	2.20	1.97	1.87	1.73	1.71	1.64	1.58
90	5.01	3.37	2.64	2.21	1.96	1.78	1.65	1.61	1.61	1.57

Table C11. Consistency for H-MAX-2; i.e., two congruent with four ascent limit (half rule with limit on the number of ascents), no update.

dB HL	SLOPES 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	5.23	3.27	2.60	2.24	1.93	1.81	1.71	1.65	1.61	1.56
-5	5.26	3.41	2.60	2.24	1.98	1.84	1.72	1.66	1.59	1.59
0	5.36	3.28	2.60	2.19	1.95	1.79	1.68	1.65	1.60	1.58
5	5.42	3.29	2.60	2.17	1.90	1.79	1.75	1.68	1.65	1.58
10	5.38	3.23	2.52	2.18	1.92	1.79	1.74	1.66	1.66	1.56
15	5.17	3.45	2.61	2.22	1.98	1.82	1.72	1.66	1.65	1.56
20	4.84	3.35	2.55	2.18	2.00	1.85	1.67	1.64	1.59	1.58
25	4.78	3.25	2.47	2.18	1.98	1.81	1.70	1.68	1.61	1.59
30	5.15	3.44	2.61	2.23	1.89	1.77	1.67	1.62	1.57	1.57
35	5.15	3.50	2.65	2.16	1.96	1.88	1.78	1.71	1.59	1.58
40	5.02	3.44	2.46	2.18	2.01	1.75	1.70	1.66	1.57	1.58
45	4.87	3.02	2.50	2.17	1.91	1.80	1.75	1.67	1.62	1.58
50	4.93	3.40	2.52	2.15	1.90	1.81	1.66	1.61	1.59	1.56
55	5.06	3.30	2.64	2.07	1.99	1.83	1.72	1.65	1.62	1.58
60	5.17	3.27	2.59	2.12	1.97	1.81	1.69	1.64	1.60	1.57
65	5.15	3.30	2.62	2.20	1.91	1.81	1.74	1.65	1.63	1.57
70	4.92	3.41	2.62	2.24	1.95	1.79	1.70	1.65	1.60	1.56
75	4.89	3.29	2.64	2.08	1.99	1.76	1.74	1.63	1.62	1.62
80	4.94	3.29	2.60	2.12	1.92	1.80	1.72	1.64	1.63	1.59
85	5.00	3.19	2.50	2.20	1.98	1.81	1.75	1.67	1.67	1.61
90	4.99	3.31	2.66	2.20	1.94	1.78	1.69	1.64	1.60	1.58

Table C12. Consistency for H-NO-2; i.e., two congruent with half rule, no limit on number of ascents, no update.

-10	5.26	3.35	2.60	2.19	1.90	1.80	1.70	1.67	1.61	1.57
-5	5.34	3.28	2.61	2.21	1.94	1.89	1.78	1.66	1.63	1.57
0	5.10	3.44	2.63	2.20	1.96	1.82	1.69	1.63	1.57	1.57
5	5.20	3.35	2.67	2.21	1.95	1.88	1.72	1.64	1.61	1.59
10	5.23	3.27	2.57	2.18	1.98	1.80	1.68	1.60	1.60	1.58
15	5.03	3.23	2.52	2.27	1.96	1.83	1.73	1.69	1.65	1.59
20	5.10	3.28	2.58	2.17	1.94	1.73	1.68	1.64	1.60	1.56
25	4.86	3.21	2.53	2.20	1.93	1.79	1.71	1.66	1.63	1.60
30	4.91	3.25	2.64	2.16	1.97	1.77	1.72	1.65	1.59	1.60
35	5.32	3.29	2.63	2.17	1.98	1.82	1.74	1.65	1.66	1.59
40	5.14	3.37	2.66	2.14	2.02	1.81	1.72	1.65	1.60	1.58
45	4.90	3.17	2.52	2.17	2.00	1.84	1.74	1.68	1.64	1.57
50	5.00	3.29	2.69	2.14	1.94	1.80	1.68	1.67	1.58	1.59
55	5.09	3.21	2.55	2.13	1.91	1.80	1.73	1.68	1.62	1.57
60	5.13	3.31	2.55	2.21	1.96	1.85	1.68	1.63	1.62	1.56
65	4.90	3.18	2.54	2.17	1.95	1.84	1.70	1.66	1.62	1.59
70	5.02	3.34	2.64	2.15	1.87	1.78	1.70	1.64	1.57	1.58
75	5.01	3.23	2.54	2.19	2.01	1.82	1.73	1.66	1.61	1.60
80	4.94	3.51	2.68	2.26	1.92	1.85	1.68	1.63	1.59	1.57
85	5.16	3.24	2.55	2.24	2.03	1.83	1.78	1.67	1.65	1.59
90	4.95	3.37	2.59	2.20	1.82	1.78	1.72	1.63	1.60	1.58

Table C13. Consistency for M-MAX-2; i.e., two congruent with three ascent limit (majority rule with limit on the number of ascents), no update.

dB HL	SLOPES 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	5.52	3.23	2.43	2.16	1.92	1.81	1.70	1.63	1.61	1.59
-5	5.56	3.33	2.45	2.08	1.97	1.84	1.70	1.73	1.64	1.58
0	5.57	3.24	2.48	2.17	1.91	1.73	1.75	1.64	1.60	1.60
5	5.48	3.45	2.56	2.23	2.03	1.82	1.72	1.66	1.60	1.59
10	5.42	3.13	2.35	2.17	1.96	1.76	1.74	1.63	1.59	1.56
15	4.81	3.16	2.62	2.23	1.98	1.81	1.71	1.68	1.63	1.60
20	4.81	3.22	2.56	2.22	1.99	1.80	1.72	1.66	1.64	1.55
25	5.09	3.14	2.49	2.20	1.90	1.80	1.75	1.64	1.62	1.56
30	5.19	3.21	2.61	2.10	1.91	1.81	1.71	1.65	1.61	1.57
35	5.43	3.31	2.53	2.21	1.98	1.79	1.64	1.64	1.64	1.62
40	5.22	3.27	2.59	2.13	2.00	1.75	1.69	1.63	1.61	1.59
45	4.88	3.02	2.49	2.10	1.98	1.87	1.73	1.66	1.60	1.58
50	4.84	3.25	2.54	2.16	1.93	1.76	1.69	1.66	1.62	1.58
55	5.08	3.14	2.45	2.16	1.91	1.79	1.73	1.71	1.63	1.58
60	4.88	3.21	2.56	2.20	1.94	1.81	1.68	1.62	1.59	1.58
65	5.00	3.04	2.45	2.11	1.95	1.83	1.75	1.67	1.61	1.57
70	4.98	3.32	2.58	2.19	1.88	1.77	1.68	1.66	1.58	1.57
75	4.92	3.14	2.56	2.20	1.99	1.83	1.79	1.67	1.63	1.59
80	5.07	3.37	2.41	2.17	1.95	1.75	1.67	1.63	1.59	1.56
85	5.03	3.27	2.54	2.21	1.95	1.85	1.73	1.65	1.61	1.58
90	5.11	3.33	2.51	2.19	1.94	1.82	1.70	1.60	1.59	1.58

Table C14. Consistency for M-NO-2; i.e., two congruent with majority rule, no limit on number of ascents, no update.

-10	5.18	3.13	2.54	2.11	1.93	1.76	1.71	1.66	1.59	1.60
-5	5.16	3.15	2.55	2.13	1.96	1.81	1.73	1.67	1.63	1.59
0	4.96	3.13	2.51	2.11	1.87	1.77	1.70	1.67	1.63	1.57
5	5.04	3.20	2.55	2.25	1.91	1.85	1.72	1.68	1.66	1.58
10	5.21	3.19	2.51	2.17	1.91	1.81	1.71	1.62	1.62	1.56
15	4.92	3.14	2.58	2.14	1.89	1.80	1.72	1.63	1.63	1.60
20	4.90	3.19	2.51	2.10	1.88	1.80	1.73	1.66	1.65	1.56
25	4.77	3.12	2.42	2.12	1.92	1.85	1.73	1.67	1.64	1.59
30	5.02	3.19	2.49	2.10	1.87	1.75	1.69	1.62	1.62	1.57
35	5.17	3.27	2.54	2.15	1.99	1.81	1.72	1.69	1.60	1.58
40	4.87	3.25	2.51	2.15	1.90	1.75	1.73	1.65	1.58	1.57
45	4.68	3.03	2.47	2.17	1.95	1.78	1.74	1.64	1.62	1.61
50	4.99	3.18	2.37	2.11	1.93	1.79	1.68	1.64	1.57	1.56
55	4.94	3.07	2.54	2.09	1.92	1.83	1.76	1.72	1.63	1.57
60	4.67	3.27	2.48	2.14	1.90	1.75	1.74	1.66	1.62	1.58
65	4.73	3.10	2.38	2.17	1.99	1.85	1.70	1.68	1.61	1.58
70	4.94	3.31	2.36	2.12	1.89	1.73	1.67	1.67	1.59	1.56
75	5.02	3.07	2.49	2.12	1.91	1.83	1.73	1.66	1.63	1.59
80	4.92	3.14	2.48	2.15	1.93	1.80	1.71	1.59	1.60	1.58
85	4.82	3.18	2.41	2.09	1.97	1.77	1.73	1.66	1.58	1.59
90	4.99	3.13	2.51	2.18	1.90	1.79	1.67	1.64	1.59	1.57

Appendix D. Average Number of Trials Required for Threshold

Table D1. Number of trials in threshold estimate for A-NO-3; i.e., first three congruent with no percent rule, no limit on number of ascents, no update.

dB HL	SLOPES 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	22.36	19.53	17.57	16.56	15.74	15.44	15.04	14.75	14.55	14.52
-5	21.68	19.11	16.98	15.87	15.29	14.92	14.49	14.23	14.01	13.86
0	21.82	18.24	16.71	15.63	14.88	14.28	13.99	13.76	13.52	13.32
5	20.62	17.61	16.19	15.05	14.28	13.67	13.51	13.24	13.08	12.87
10	20.52	17.50	15.51	14.68	13.84	13.33	12.99	12.83	12.54	12.40
15	20.37	16.82	15.09	14.09	13.32	12.80	12.56	12.31	11.97	12.00
20	20.15	16.71	14.65	13.49	12.77	12.26	11.93	11.75	11.50	11.31
25	20.43	16.53	14.35	13.19	12.32	11.82	11.31	11.34	11.03	10.88
30	20.74	17.37	15.63	14.65	13.75	13.25	12.91	12.49	12.44	12.10
35	21.30	17.95	16.05	15.06	14.45	13.89	13.51	13.14	13.15	12.85
40	21.18	17.67	15.71	14.64	13.79	13.30	12.91	12.75	12.57	12.47
45	21.03	17.25	15.27	14.19	13.38	12.75	12.40	12.28	12.04	11.87
50	21.50	18.20	16.34	15.09	14.40	13.56	13.31	13.21	12.85	12.65
55	22.16	18.34	16.27	15.16	14.43	13.85	13.53	13.21	13.14	12.85
60	22.43	18.99	17.41	15.91	15.45	14.73	14.32	13.93	13.85	13.66
65	22.89	19.20	17.20	16.08	15.36	14.72	14.47	14.08	14.06	13.96
70	23.89	20.02	18.24	17.27	16.42	15.68	15.40	15.09	14.86	14.64
75	24.04	20.40	18.24	17.26	16.43	15.80	15.46	15.15	15.07	14.80
80	24.47	20.99	19.20	18.09	17.21	16.83	16.37	16.08	15.73	15.66
85	25.05	21.35	19.21	18.10	17.43	16.76	16.51	16.25	16.06	15.89
90	25.36	21.96	20.51	19.00	18.32	17.74	17.42	17.13	16.75	16.68

Table D2. Number of trials in threshold estimate for H-UP-3; i.e., three congruent out of last six (half rule with updates), no limit on number of ascents.

-10	24.93	20.05	18.00	16.55	15.63	15.35	15.04	14.61	14.70	14.41
-5	24.00	19.40	16.98	15.91	15.29	14.95	14.44	14.22	13.95	13.80
0	23.76	18.89	16.79	15.49	14.73	14.33	14.06	13.76	13.47	13.39
5	23.00	18.41	16.21	15.17	14.27	13.83	13.29	13.13	13.02	12.95
10	22.54	17.87	15.77	14.73	13.84	13.41	13.00	12.81	12.62	12.42
15	22.22	17.07	15.23	14.08	13.23	12.80	12.53	12.25	12.06	11.93
20	21.79	17.00	14.57	13.76	12.77	12.34	12.10	11.69	11.60	11.44
25	22.42	16.84	14.54	13.13	12.30	11.74	11.49	11.26	11.06	10.85
30	23.16	17.99	15.70	14.39	13.91	13.22	12.83	12.53	12.36	12.12
35	22.53	18.30	16.07	15.16	14.43	13.81	13.46	13.22	13.04	12.92
40	23.07	17.83	15.58	14.58	13.83	13.42	13.02	12.74	12.57	12.35
45	23.13	17.66	15.44	14.18	13.40	12.83	12.48	12.15	12.13	11.97
50	23.80	18.51	16.22	15.20	14.25	13.85	13.36	13.10	12.85	12.65
55	24.41	18.79	16.45	15.20	14.55	13.93	13.43	13.23	13.02	12.84
60	24.53	19.60	17.31	16.26	15.33	14.84	14.17	14.06	13.85	13.68
65	25.25	19.57	17.48	16.12	15.28	14.77	14.60	14.25	14.13	13.82
70	25.76	20.47	18.34	17.11	16.44	15.77	15.32	15.06	14.74	14.64
75	25.96	20.94	18.38	17.17	16.36	15.82	15.45	15.18	15.03	14.87
80	26.34	21.69	19.37	18.13	17.25	16.70	16.26	16.09	15.91	15.63
85	27.05	21.66	19.50	18.20	17.33	16.79	16.53	16.12	16.11	15.85
90	27.66	22.69	20.38	19.25	18.27	17.83	17.34	17.10	16.86	16.71

Table D3. Number of trials in threshold estimate for M-UP-3; i.e., three congruent out of last five (majority rule with updates), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	28.58	21.13	18.01	16.95	15.82	15.32	14.86	14.80	14.55	14.31
-5	27.15	20.33	17.72	16.30	15.50	14.83	14.47	14.24	13.98	13.88
0	26.48	19.78	17.33	15.78	14.79	14.27	14.01	13.61	13.58	13.36
5	26.20	19.35	16.80	15.01	14.53	13.87	13.40	13.26	12.97	12.81
10	25.79	18.85	16.17	14.81	13.97	13.43	13.01	12.85	12.72	12.39
15	25.52	18.13	15.86	14.13	13.44	12.88	12.37	12.35	12.13	12.00
20	26.05	17.79	15.16	13.92	12.86	12.44	11.86	11.83	11.56	11.46
25	25.67	17.91	14.97	13.23	12.40	11.86	11.46	11.09	11.05	10.85
30	25.97	19.27	16.38	14.80	14.01	13.23	12.89	12.43	12.33	12.25
35	27.58	19.52	16.58	15.19	14.41	13.87	13.53	13.32	12.96	12.84
40	26.89	18.91	16.28	14.73	13.98	13.41	12.97	12.80	12.58	12.40
45	27.02	18.55	15.71	14.45	13.58	12.95	12.51	12.15	11.99	11.74
50	26.91	19.48	16.75	14.98	14.40	13.77	13.52	13.05	12.86	12.70
55	27.60	20.27	16.99	15.41	14.35	13.98	13.57	13.21	13.07	12.69
60	27.75	20.54	17.77	16.50	15.24	14.76	14.37	14.19	14.03	13.65
65	28.69	20.64	17.80	16.34	15.52	14.95	14.55	14.34	13.95	13.94
70	28.94	21.65	18.69	17.46	16.36	15.84	15.50	15.08	14.88	14.81
75	29.24	22.07	19.29	17.44	16.29	15.79	15.55	15.11	15.06	14.92
80	30.11	22.60	19.90	18.22	17.31	16.73	16.33	16.03	15.87	15.66
85	31.10	22.84	20.06	18.19	17.40	16.84	16.44	16.39	15.99	15.87
90	31.25	23.37	20.83	19.32	18.21	17.71	17.49	17.09	16.78	16.66

Table D4. Number of trials in threshold estimate for H-MAX-3; i.e., three congruent with six ascent limit (half rule with limit on the number of ascents), no update.

-10	33.30	21.35	18.42	16.80	15.93	15.40	15.02	14.75	14.53	14.33
-5	33.31	21.24	17.51	16.21	15.27	14.83	14.55	14.30	14.05	13.92
0	31.59	20.35	16.95	15.67	14.83	14.38	13.91	13.77	13.52	13.40
5	29.86	19.85	16.60	15.23	14.21	13.87	13.55	13.26	13.06	12.90
10	32.18	19.01	16.16	14.83	13.95	13.38	13.12	12.79	12.55	12.34
15	30.99	19.52	15.53	14.15	13.29	12.67	12.60	12.12	12.08	11.96
20	28.34	18.77	15.06	13.55	12.95	12.37	12.00	11.71	11.48	11.29
25	28.11	18.53	14.76	13.32	12.25	11.95	11.57	11.09	11.00	10.82
30	29.96	19.81	16.36	14.78	13.78	13.33	12.83	12.42	12.24	12.15
35	30.17	20.52	16.79	15.05	14.21	13.92	13.46	13.21	13.13	12.83
40	29.42	19.32	16.07	14.61	13.85	13.34	13.03	12.69	12.55	12.45
45	30.06	19.09	15.73	14.10	13.35	12.93	12.36	12.26	12.07	11.90
50	29.90	20.23	16.98	15.53	14.33	13.63	13.34	13.10	12.94	12.63
55	30.91	20.75	16.87	15.25	14.42	13.77	13.50	13.28	13.09	12.82
60	30.96	21.24	17.78	16.23	15.28	14.71	14.39	13.97	13.81	13.66
65	31.63	21.87	17.78	16.14	15.21	14.71	14.57	14.21	14.09	13.96
70	32.40	22.02	18.57	17.07	16.35	15.67	15.41	15.02	14.94	14.67
75	34.38	22.19	18.74	17.14	16.15	15.84	15.56	15.24	14.97	14.90
80	33.94	23.18	19.91	18.06	17.38	16.73	16.30	16.01	15.90	15.55
85	33.83	23.52	19.76	18.17	17.44	16.83	16.40	16.29	16.00	15.92
90	34.44	24.16	20.55	19.45	18.14	17.78	17.32	16.99	16.86	16.70

Table D5. Number of trials in threshold estimate for H-NO-3; i.e., three congruent with half rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	44.53	22.69	18.38	16.84	15.79	15.40	15.04	14.79	14.56	14.48
-5	43.27	22.18	17.75	16.16	15.31	14.90	14.57	14.16	14.14	13.89
0	44.77	21.40	17.34	15.76	14.83	14.29	13.99	13.68	13.60	13.29
5	41.76	21.06	16.54	15.41	14.31	13.85	13.49	13.15	12.92	12.82
10	40.52	20.11	15.94	14.68	13.77	13.45	12.96	12.68	12.64	12.39
15	41.65	20.56	16.00	14.26	13.35	12.84	12.48	12.12	12.02	11.80
20	36.83	19.79	15.59	13.78	12.87	12.47	12.08	11.72	11.61	11.34
25	37.55	19.68	14.78	13.45	12.43	11.94	11.48	11.21	11.01	10.85
30	37.79	20.43	16.15	14.67	13.91	13.22	12.84	12.55	12.32	12.11
35	38.86	22.41	16.83	15.49	14.31	13.91	13.55	13.17	13.07	12.83
40	37.73	20.47	16.52	14.56	13.97	13.31	13.04	12.79	12.55	12.42
45	39.08	20.33	15.68	14.18	13.22	12.86	12.55	12.17	12.11	11.88
50	38.95	20.78	16.64	15.23	14.46	13.90	13.45	13.06	12.85	12.66
55	40.47	21.73	16.98	15.40	14.31	13.94	13.42	13.27	13.07	12.82
60	39.35	21.99	17.82	16.33	15.41	14.78	14.40	14.03	13.87	13.75
65	40.22	22.08	17.96	16.22	15.41	14.83	14.43	14.17	14.03	13.86
70	40.91	22.76	18.91	17.36	16.30	15.69	15.39	15.01	14.86	14.65
75	39.99	23.26	18.50	17.10	16.28	15.83	15.60	15.18	15.02	14.84
80	39.88	24.34	20.00	18.15	17.28	16.62	16.43	16.13	15.85	15.67
85	41.89	23.79	20.00	18.29	17.36	16.91	16.47	16.25	16.09	15.81
90	39.88	24.93	20.68	19.18	18.36	17.81	17.33	17.11	16.86	16.70

Table D6. Number of trials in threshold estimate for M-MAX-3; i.e., three congruent with five ascent limit (majority rule with limit on the number of ascents), no update.

-10	59.11	26.58	19.57	17.30	16.04	15.49	15.04	14.72	14.48	14.34
-5	54.38	25.77	19.79	16.69	15.55	14.85	14.42	14.19	13.93	13.87
0	49.74	25.02	18.52	16.40	15.09	14.58	13.95	13.71	13.59	13.39
5	46.53	24.95	18.02	16.07	14.48	13.86	13.49	13.27	12.94	12.81
10	46.44	24.14	17.68	15.29	14.13	13.40	13.01	12.84	12.53	12.38
15	42.87	24.30	17.78	14.74	13.44	12.80	12.42	12.34	11.97	11.91
20	41.01	22.65	17.37	14.26	13.13	12.33	12.04	11.76	11.57	11.38
25	42.31	21.81	16.10	13.69	12.57	11.84	11.54	11.20	10.99	10.93
30	43.38	23.97	18.11	15.31	14.18	13.39	12.92	12.66	12.38	12.01
35	44.26	25.54	18.08	15.71	14.50	14.07	13.49	13.19	13.09	12.84
40	39.97	23.08	17.72	15.20	14.02	13.45	12.94	12.59	12.46	12.42
45	38.61	23.02	17.52	14.91	13.63	12.93	12.48	12.28	11.99	11.86
50	43.56	24.53	18.11	15.74	14.44	13.84	13.36	13.14	12.80	12.65
55	43.74	23.84	18.94	15.69	14.61	13.69	13.47	13.18	13.06	12.96
60	44.59	25.95	19.33	16.97	15.59	14.84	14.23	14.01	13.93	13.59
65	44.34	25.63	19.37	16.66	15.60	14.88	14.46	14.24	14.00	13.90
70	45.51	26.45	20.26	17.92	16.49	15.78	15.28	15.20	14.92	14.73
75	44.57	26.68	20.80	17.88	16.60	15.73	15.49	15.14	15.04	14.89
80	45.10	28.07	21.51	19.14	17.68	16.86	16.34	16.23	15.73	15.60
85	46.19	26.44	21.11	18.89	17.60	16.90	16.43	16.20	16.04	15.78
90	45.72	28.09	22.17	20.19	18.56	17.65	17.38	17.09	16.91	16.56

Table D7. Number of trials in threshold estimate for M-NO-3; i.e., three congruent with majority rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	77.79	30.08	20.44	17.89	16.12	15.32	15.02	14.59	14.59	14.49
-5	77.60	29.93	19.84	16.91	15.43	14.82	14.52	14.14	14.03	13.86
0	74.50	27.89	19.39	16.31	15.09	14.43	14.02	13.78	13.55	13.28
5	70.15	29.25	19.01	16.21	14.66	13.83	13.49	13.13	13.02	12.84
10	69.72	28.48	18.89	15.77	14.12	13.56	13.05	12.75	12.46	12.50
15	60.57	27.21	19.13	15.15	13.75	12.90	12.44	12.28	12.00	11.90
20	60.24	25.83	18.48	14.54	13.15	12.45	11.95	11.81	11.52	11.32
25	60.98	25.49	17.48	13.80	12.55	11.77	11.47	11.38	11.04	10.91
30	63.54	28.72	19.04	15.35	14.10	13.27	12.84	12.54	12.41	12.10
35	64.21	30.12	19.33	15.83	14.44	13.90	13.45	13.26	12.94	12.91
40	59.81	28.45	18.67	15.06	14.12	13.52	13.05	12.72	12.48	12.42
45	60.99	26.92	18.43	14.91	13.63	12.94	12.33	12.17	12.02	11.92
50	64.05	29.66	19.38	15.91	14.39	13.78	13.28	13.08	12.92	12.63
55	58.69	27.84	19.28	15.76	14.40	13.84	13.47	13.22	12.91	12.92
60	62.25	30.17	19.81	17.05	15.23	14.87	14.40	14.02	13.85	13.60
65	65.02	28.25	20.49	17.05	15.62	14.92	14.57	14.22	14.09	13.89
70	59.99	30.09	20.57	17.76	16.49	15.86	15.36	15.06	14.95	14.71
75	64.65	29.97	21.39	18.16	16.53	15.82	15.40	15.27	15.08	14.92
80	67.05	30.78	21.94	19.06	17.68	16.86	16.41	16.07	15.91	15.60
85	63.92	30.77	22.65	18.72	17.78	16.88	16.53	16.26	15.99	15.85
90	66.58	31.78	23.18	19.93	18.43	17.86	17.56	17.03	16.86	16.66

Table D8. Number of trials in threshold estimate for A-NO-2; i.e., first two congruent with no percent rule, no limit on number of ascents, no update.

-10	13.93	13.06	12.24	11.85	11.43	11.17	11.04	10.89	10.77	10.69
-5	13.55	12.48	11.69	11.18	10.83	10.63	10.46	10.37	10.27	10.19
0	12.95	12.00	11.26	10.67	10.46	10.26	10.01	9.92	9.75	9.69
5	12.59	11.42	10.74	10.17	9.93	9.61	9.51	9.29	9.24	9.17
10	12.01	10.90	10.40	9.74	9.44	9.14	9.01	8.96	8.79	8.78
15	11.58	10.53	9.54	9.26	8.81	8.64	8.46	8.32	8.23	8.22
20	11.62	10.15	9.29	8.87	8.43	8.21	8.00	7.95	7.74	7.78
25	11.86	10.10	9.22	8.37	8.00	7.57	7.51	7.36	7.24	7.19
30	12.20	11.19	10.33	9.80	9.42	9.13	8.87	8.69	8.52	8.44
35	12.46	11.49	10.53	10.23	9.86	9.59	9.52	9.26	9.27	9.14
40	12.69	11.05	10.28	9.71	9.46	9.24	9.11	8.93	8.85	8.78
45	12.63	11.02	9.93	9.29	8.89	8.59	8.48	8.41	8.24	8.19
50	13.09	11.62	10.93	10.30	9.82	9.70	9.45	9.18	9.10	8.95
55	13.46	11.98	10.95	10.18	9.96	9.71	9.53	9.39	9.23	9.14
60	14.32	12.56	11.83	11.27	10.81	10.47	10.38	10.13	10.07	10.00
65	14.67	13.07	12.03	11.21	10.86	10.64	10.43	10.41	10.18	10.17
70	14.99	13.54	12.75	12.22	12.02	11.56	11.35	11.32	11.13	10.96
75	15.62	13.92	13.05	12.39	11.98	11.74	11.42	11.39	11.25	11.21
80	15.99	14.64	13.77	13.18	12.92	12.65	12.37	12.19	12.06	12.01
85	16.72	15.10	14.01	13.24	12.96	12.60	12.35	12.38	12.23	12.17
90	17.08	15.62	14.82	14.27	13.90	13.72	13.34	13.30	13.14	12.96

Table D9. Number of trials in threshold estimate for M-UP-2; i.e., two congruent out of last four (half rule with updates), no limit on number of ascents.

dB HL	SLOPES 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	14.18	13.15	12.22	11.80	11.42	11.23	11.11	10.86	10.83	10.80
-5	13.85	12.34	11.77	11.19	10.87	10.68	10.47	10.40	10.32	10.23
0	13.27	11.90	11.20	10.74	10.50	10.17	10.03	9.79	9.74	9.73
5	12.93	11.59	10.48	10.27	9.80	9.65	9.42	9.29	9.19	9.15
10	12.03	10.88	10.29	9.83	9.50	9.19	9.02	8.85	8.80	8.76
15	11.95	10.37	9.72	9.11	8.81	8.65	8.47	8.35	8.26	8.18
20	11.94	10.04	9.26	8.68	8.29	8.19	8.08	7.95	7.77	7.73
25	12.19	10.22	9.02	8.27	7.94	7.73	7.45	7.37	7.32	7.21
30	12.31	11.19	10.34	9.83	9.32	9.15	9.02	8.75	8.54	8.56
35	12.60	11.48	10.68	10.22	9.92	9.65	9.44	9.31	9.27	9.13
40	13.00	11.07	10.34	9.70	9.52	9.15	9.06	8.90	8.81	8.73
45	13.09	11.00	9.82	9.31	8.89	8.73	8.56	8.32	8.21	8.16
50	13.39	11.61	10.83	10.28	9.91	9.61	9.38	9.18	9.12	8.94
55	13.78	12.03	10.93	10.36	9.88	9.71	9.58	9.35	9.23	9.19
60	14.35	12.46	11.91	11.40	10.89	10.59	10.34	10.19	10.09	10.08
65	14.97	12.94	11.96	11.40	10.90	10.59	10.56	10.31	10.29	10.18
70	15.31	13.67	12.84	12.34	11.85	11.60	11.46	11.25	11.03	10.98
75	15.62	14.10	12.95	12.41	11.96	11.71	11.49	11.27	11.24	11.12
80	16.22	14.78	13.87	13.27	12.93	12.72	12.35	12.23	12.08	11.98
85	16.92	15.24	14.04	13.27	12.92	12.74	12.49	12.35	12.31	12.22
90	17.31	15.74	14.91	14.28	13.91	13.53	13.37	13.26	13.13	13.06

Table D10. Number of trials in threshold estimate for M-UP-2; i.e., two congruent out of last three (majority rule with updates), no limit on number of ascents.

-10	15.17	13.42	12.52	12.00	11.50	11.27	11.06	10.91	10.85	10.76
-5	14.75	12.98	11.87	11.37	10.98	10.57	10.43	10.31	10.24	10.17
0	14.06	12.33	11.23	10.85	10.53	10.23	9.98	9.81	9.74	9.73
5	13.49	11.96	11.01	10.28	9.95	9.66	9.52	9.39	9.22	9.18
10	12.81	11.46	10.37	9.88	9.43	9.12	9.10	8.91	8.84	8.73
15	12.90	11.16	9.94	9.36	8.92	8.61	8.43	8.36	8.30	8.16
20	12.46	10.53	9.41	8.95	8.49	8.09	8.03	7.98	7.78	7.77
25	12.88	10.45	9.28	8.44	8.01	7.66	7.51	7.35	7.25	7.18
30	13.43	11.50	10.59	9.97	9.56	9.13	8.88	8.63	8.53	8.44
35	13.61	11.73	10.94	10.08	9.90	9.66	9.59	9.31	9.31	9.19
40	13.60	11.68	10.43	9.84	9.64	9.20	9.04	8.93	8.77	8.73
45	14.02	11.57	10.10	9.37	8.98	8.75	8.46	8.34	8.20	8.23
50	14.05	12.02	11.18	10.47	9.94	9.62	9.48	9.15	9.06	8.99
55	15.01	12.46	11.29	10.26	10.06	9.67	9.49	9.28	9.29	9.18
60	15.47	12.97	11.93	11.32	10.94	10.57	10.39	10.20	10.11	10.01
65	16.01	13.55	12.02	11.30	10.98	10.68	10.46	10.39	10.24	10.14
70	16.27	14.04	13.03	12.37	11.96	11.65	11.34	11.22	11.16	10.98
75	16.90	14.61	13.15	12.38	11.82	11.73	11.45	11.37	11.26	11.19
80	17.27	15.11	14.02	13.49	12.98	12.68	12.36	12.30	12.06	12.05
85	17.90	15.56	14.33	13.46	12.91	12.77	12.47	12.32	12.27	12.20
90	18.31	16.09	14.97	14.40	13.93	13.72	13.41	13.21	13.12	12.91

Table D11. Number of trials in threshold estimate for H-MAX-2; i.e., two congruent with four ascent limit (half rule with limit on the number of acents), no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	15.66	13.15	12.42	11.78	11.39	11.08	11.01	10.86	10.76	10.70
-5	15.25	12.71	11.85	11.20	10.81	10.64	10.44	10.39	10.21	10.17
0	14.39	12.13	11.49	10.88	10.38	10.21	9.97	9.90	9.80	9.72
5	13.56	11.69	10.60	10.21	9.81	9.71	9.50	9.34	9.36	9.16
10	12.91	11.07	10.32	9.77	9.43	9.14	9.07	8.94	8.84	8.70
15	12.54	10.66	9.66	9.22	8.77	8.73	8.47	8.31	8.21	8.19
20	12.45	10.46	9.22	8.84	8.35	8.32	8.06	7.87	7.78	7.72
25	12.90	10.34	9.01	8.42	7.94	7.69	7.39	7.35	7.26	7.18
30	13.33	11.18	10.33	9.80	9.35	9.10	8.82	8.78	8.65	8.41
35	13.70	11.51	10.78	10.17	9.86	9.65	9.43	9.39	9.25	9.20
40	13.65	11.23	10.20	9.77	9.47	9.16	9.03	8.87	8.75	8.67
45	13.85	11.23	9.92	9.19	8.84	8.67	8.47	8.35	8.35	8.18
50	13.95	11.84	10.91	10.30	10.00	9.66	9.37	9.29	9.10	9.01
55	14.28	12.12	11.13	10.30	9.94	9.67	9.43	9.37	9.28	9.19
60	15.30	12.65	11.98	11.32	10.92	10.53	10.39	10.20	10.12	9.95
65	15.88	13.15	11.94	11.27	10.88	10.63	10.53	10.30	10.27	10.14
70	16.19	13.80	12.79	12.29	11.95	11.64	11.34	11.28	11.05	10.99
75	16.81	14.13	13.11	12.29	11.94	11.60	11.41	11.39	11.23	11.10
80	17.28	14.96	13.97	13.32	12.97	12.72	12.36	12.24	12.15	11.97
85	17.85	15.16	14.01	13.36	12.89	12.65	12.45	12.40	12.27	12.15
90	18.24	15.94	14.85	14.30	13.92	13.61	13.36	13.27	13.10	12.94

Table D12. Number of trials in threshold estimate for H-NO-2; i.e., two congruent with half rule, no limit on number of ascents, no update.

-10	20.05	13.58	12.32	11.81	11.42	11.11	11.09	10.88	10.84	10.72
-5	19.88	12.94	11.71	11.22	10.73	10.59	10.46	10.30	10.26	10.15
0	19.40	12.65	11.47	10.67	10.49	10.23	10.03	9.82	9.77	9.69
5	18.31	12.19	10.73	10.17	9.84	9.64	9.53	9.37	9.29	9.11
10	16.80	11.41	10.23	9.77	9.45	9.20	9.02	8.94	8.80	8.71
15	16.91	11.07	9.69	9.24	8.87	8.72	8.52	8.46	8.22	8.14
20	16.10	10.55	9.32	8.80	8.38	8.16	8.00	7.94	7.80	7.80
25	16.64	10.35	9.02	8.28	7.84	7.72	7.46	7.35	7.28	7.18
30	16.53	11.94	10.35	9.84	9.40	9.11	8.94	8.68	8.66	8.51
35	18.23	12.03	10.67	10.23	9.85	9.60	9.51	9.34	9.27	9.16
40	17.53	11.65	10.34	9.92	9.39	9.20	8.99	8.88	8.82	8.69
45	17.39	11.61	10.06	9.28	8.86	8.72	8.52	8.38	8.28	8.15
50	17.04	12.23	10.87	10.27	9.98	9.63	9.34	9.23	9.12	8.96
55	17.99	12.63	11.06	10.39	9.89	9.71	9.47	9.34	9.31	9.18
60	18.72	13.23	11.86	11.32	10.94	10.66	10.43	10.27	10.03	9.98
65	18.97	13.74	11.96	11.37	10.91	10.73	10.51	10.43	10.31	10.14
70	18.73	14.53	12.80	12.31	11.99	11.64	11.40	11.23	11.11	10.98
75	19.53	14.61	13.01	12.32	11.96	11.63	11.47	11.44	11.19	11.15
80	19.69	15.63	13.90	13.34	12.87	12.71	12.38	12.22	12.12	11.95
85	20.60	15.83	13.99	13.38	12.97	12.69	12.47	12.33	12.18	12.23
90	21.21	16.23	14.96	14.37	13.99	13.60	13.48	13.16	13.05	12.96

Table D13. Number of trials in threshold estimate for M-MAX-2; i.e., two congruent with three ascent limit (majority rule with limit on the number of ascents), no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	23.37	14.81	12.85	12.15	11.48	11.28	10.94	10.85	10.82	10.69
-5	23.46	14.28	12.58	11.49	11.06	10.62	10.45	10.37	10.29	10.24
0	21.42	13.63	11.90	10.97	10.59	10.26	10.08	9.98	9.78	9.72
5	18.65	13.18	11.64	10.76	9.98	9.71	9.44	9.28	9.30	9.19
10	16.76	12.60	11.09	9.99	9.37	9.20	9.00	8.86	8.83	8.72
15	16.86	12.29	10.47	9.50	9.13	8.64	8.50	8.34	8.38	8.20
20	16.38	11.82	9.84	9.15	8.63	8.15	8.08	7.98	7.85	7.78
25	16.61	11.56	9.46	8.64	7.98	7.66	7.50	7.34	7.26	7.25
30	15.51	12.90	11.30	9.94	9.53	9.14	8.97	8.77	8.61	8.47
35	16.92	13.00	11.54	10.57	10.08	9.68	9.46	9.38	9.24	9.13
40	18.02	12.68	10.93	10.08	9.50	9.23	9.00	8.90	8.85	8.73
45	17.09	12.20	10.37	9.60	9.02	8.72	8.53	8.37	8.27	8.15
50	17.16	13.48	11.79	10.67	10.02	9.63	9.40	9.23	9.06	9.00
55	17.57	14.05	11.57	10.72	10.00	9.74	9.45	9.39	9.25	9.16
60	19.36	15.03	12.65	11.84	11.05	10.72	10.48	10.23	10.10	9.96
65	19.02	14.67	12.78	11.65	11.07	10.70	10.50	10.42	10.21	10.16
70	19.84	15.64	14.00	12.68	12.04	11.74	11.42	11.15	11.11	10.97
75	19.59	15.66	13.84	12.86	12.16	11.70	11.50	11.39	11.31	11.20
80	20.58	16.76	14.59	13.47	13.00	12.72	12.27	12.20	12.04	11.99
85	20.97	16.61	14.76	13.53	13.08	12.64	12.50	12.28	12.26	12.15
90	21.92	17.71	15.55	14.70	14.07	13.61	13.47	13.22	13.15	12.98

Table D14. Number of trials in threshold estimate for M-NO-2; i.e., two congruent with majority rule, no limit on number of ascents, no update.

-10	39.29	18.53	14.03	12.40	11.54	11.31	11.08	10.93	10.78	10.72
-5	41.60	18.46	13.58	12.04	11.10	10.70	10.48	10.42	10.19	10.20
0	35.70	17.65	13.49	11.67	10.76	10.33	10.08	9.87	9.70	9.69
5	34.31	17.51	12.73	10.90	10.21	9.60	9.51	9.36	9.31	9.18
10	33.04	16.57	12.11	10.48	9.88	9.23	9.16	8.89	8.82	8.70
15	30.46	16.37	11.48	9.66	9.10	8.66	8.46	8.28	8.28	8.15
20	28.74	14.96	11.06	9.36	8.61	8.26	8.05	7.97	7.86	7.61
25	29.48	14.27	10.77	9.07	8.05	7.78	7.53	7.39	7.34	7.16
30	28.91	16.43	12.39	10.59	9.69	9.22	8.91	8.68	8.63	8.62
35	29.17	17.21	12.40	11.18	10.00	9.70	9.47	9.38	9.26	9.19
40	30.09	16.63	12.12	10.35	9.46	9.20	9.06	8.91	8.86	8.72
45	28.63	15.81	11.29	9.84	9.26	8.63	8.55	8.38	8.25	8.17
50	28.25	17.30	12.86	10.96	10.05	9.71	9.32	9.21	8.96	9.00
55	30.51	16.34	12.78	11.07	10.00	9.75	9.51	9.41	9.21	9.11
60	30.36	18.28	13.97	11.98	11.03	10.67	10.43	10.30	10.09	9.96
65	31.07	18.25	13.74	11.82	11.15	10.66	10.44	10.36	10.28	10.18
70	30.47	18.12	14.71	13.04	12.23	11.62	11.41	11.23	11.09	10.96
75	31.95	18.94	14.76	12.61	12.10	11.82	11.63	11.46	11.30	11.21
80	31.75	19.90	15.33	13.58	12.96	12.69	12.32	12.18	12.10	11.94
85	33.19	19.44	15.57	13.89	13.19	12.82	12.42	12.31	12.20	12.14
90	34.80	20.48	16.54	14.95	14.08	13.59	13.44	13.32	13.10	13.00

Appendix E. Standard Deviation of the Number of Trials Required for Threshold

Table E1. Variability (standard deviation) of number of trials for A-NO-3; i.e., first three congruent with no percent rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	5.81	4.27	3.67	3.13	2.81	2.65	2.60	2.48	2.38	2.45
-5	5.57	4.35	3.45	3.02	2.68	2.48	2.40	2.21	2.23	2.17
0	5.91	4.12	3.60	3.12	2.84	2.66	2.55	2.51	2.39	2.38
5	5.75	4.09	3.37	3.00	2.65	2.46	2.30	2.28	2.28	2.16
10	5.59	4.24	3.59	3.12	2.91	2.73	2.63	2.55	2.39	2.44
15	5.85	4.18	3.44	2.96	2.59	2.48	2.35	2.30	2.17	2.25
20	5.81	4.24	3.61	3.20	2.83	2.70	2.59	2.51	2.40	2.25
25	5.95	4.40	3.42	3.05	2.68	2.47	2.28	2.32	2.21	2.19
30	5.80	4.11	3.55	3.19	2.82	2.77	2.67	2.57	2.58	2.39
35	5.73	4.18	3.42	2.93	2.74	2.53	2.37	2.19	2.31	2.16
40	5.75	4.25	3.64	3.12	2.89	2.70	2.53	2.47	2.44	2.42
45	5.67	4.37	3.48	3.05	2.73	2.44	2.28	2.33	2.28	2.16
50	5.82	4.26	3.51	3.10	2.93	2.61	2.54	2.49	2.42	2.42
55	5.78	4.24	3.49	2.94	2.67	2.46	2.30	2.27	2.25	2.13
60	5.74	4.32	3.57	3.09	2.85	2.64	2.50	2.35	2.53	2.41
65	5.70	4.35	3.38	2.94	2.64	2.44	2.34	2.16	2.21	2.18
70	5.59	4.24	3.48	3.22	2.90	2.63	2.55	2.54	2.46	2.35
75	5.74	4.13	3.45	2.99	2.73	2.44	2.36	2.24	2.22	2.09
80	5.55	4.13	3.56	3.06	2.81	2.68	2.60	2.55	2.29	2.43
85	5.89	4.24	3.44	3.01	2.76	2.45	2.32	2.29	2.19	2.12
90	5.64	4.21	3.56	3.12	2.81	2.67	2.55	2.49	2.28	2.35

Table E2. Variability (standard deviation) of number of trials for H-UP-3; i.e., three congruent out of last six (half rule with updates), no limit on number of ascents.

-10	10.10	5.44	4.04	3.25	2.93	2.66	2.60	2.46	2.45	2.32
-5	9.55	5.21	3.70	2.93	2.70	2.54	2.37	2.26	2.20	2.06
0	9.80	5.40	3.93	3.15	2.85	2.63	2.55	2.48	2.39	2.37
5	9.38	5.34	3.47	3.01	2.62	2.44	2.24	2.18	2.25	2.23
10	10.17	5.58	3.65	3.18	2.85	2.68	2.58	2.56	2.52	2.35
15	9.75	5.08	3.83	2.98	2.66	2.42	2.41	2.29	2.25	2.22
20	9.22	5.55	3.66	3.34	2.89	2.73	2.62	2.51	2.43	2.42
25	9.62	4.98	3.80	3.16	2.66	2.47	2.37	2.27	2.24	2.14
30	10.54	5.19	3.91	3.10	2.93	2.86	2.63	2.57	2.48	2.40
35	8.80	5.38	3.62	3.10	2.74	2.47	2.29	2.33	2.23	2.15
40	9.72	5.36	3.79	3.33	2.95	2.64	2.59	2.45	2.46	2.32
45	9.63	5.40	3.79	3.02	2.66	2.43	2.29	2.24	2.25	2.18
50	9.68	5.07	3.78	3.17	2.79	2.64	2.57	2.48	2.48	2.40
55	10.18	5.24	3.81	3.23	2.72	2.47	2.32	2.29	2.22	2.14
60	9.78	5.27	3.70	3.22	2.83	2.72	2.47	2.48	2.39	2.38
65	9.60	4.90	3.78	3.00	2.71	2.49	2.45	2.29	2.27	2.07
70	9.22	4.99	3.76	3.19	2.97	2.70	2.55	2.44	2.38	2.34
75	9.60	5.48	3.64	3.14	2.55	2.54	2.34	2.19	2.23	2.17
80	9.11	5.07	3.90	3.31	2.90	2.63	2.49	2.53	2.41	2.37
85	9.56	5.27	3.78	3.09	2.70	2.43	2.36	2.24	2.29	2.20
90	9.12	5.39	3.57	3.09	2.79	2.74	2.52	2.51	2.50	2.38

Table E3. Variability (standard deviation) of number of trials for M-UP-3; i.e., three congruent out of last five (majority rule with updates), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	15.66	7.96	4.71	3.93	3.10	2.63	2.55	2.60	2.46	2.27
-5	13.97	7.01	4.92	3.47	3.02	2.53	2.35	2.29	2.19	2.14
0	14.08	7.12	5.19	3.32	2.98	2.67	2.62	2.47	2.48	2.31
5	13.72	7.26	4.67	3.53	2.95	2.65	2.33	2.27	2.16	2.14
10	14.32	7.61	4.91	3.81	3.13	2.87	2.65	2.52	2.46	2.37
15	13.73	7.27	4.94	3.50	2.85	2.43	2.27	2.29	2.27	2.26
20	14.32	7.29	4.95	4.08	2.88	2.86	2.61	2.52	2.42	2.41
25	15.03	7.56	4.78	3.39	3.04	2.57	2.39	2.22	2.21	2.11
30	14.26	7.97	4.72	3.91	2.99	2.74	2.70	2.44	2.49	2.55
35	14.78	7.89	4.59	3.67	2.81	2.58	2.36	2.30	2.13	2.16
40	14.19	7.32	4.70	3.69	3.07	2.84	2.56	2.56	2.43	2.37
45	15.39	6.81	4.56	3.77	2.93	2.57	2.45	2.27	2.18	2.03
50	15.27	6.90	4.61	3.26	3.08	2.72	2.56	2.44	2.44	2.44
55	15.44	7.71	4.77	3.57	2.84	2.46	2.39	2.26	2.21	2.01
60	14.09	7.03	5.16	3.83	2.78	2.65	2.57	2.59	2.56	2.33
65	14.43	7.34	4.46	3.73	2.94	2.68	2.46	2.32	2.21	2.23
70	14.07	7.55	4.76	3.98	3.17	2.69	2.64	2.49	2.47	2.44
75	14.08	6.82	5.04	3.60	2.71	2.53	2.37	2.22	2.16	2.22
80	15.20	7.32	4.67	3.72	2.96	2.64	2.62	2.45	2.53	2.42
85	15.28	7.06	4.83	3.50	2.93	2.58	2.43	2.35	2.17	2.16
90	15.24	7.03	5.01	3.68	2.89	2.74	2.62	2.47	2.42	2.45

Table E4. Variability (standard deviation) of number of trials for H-MAX-3; i.e., three congruent with six ascent limit (half rule with limit on the number of ascents), no update.

-10	31.74	8.37	5.17	3.83	2.83	2.69	2.61	2.51	2.49	2.33
-5	26.76	9.24	4.83	3.39	2.78	2.49	2.39	2.35	2.16	2.22
0	22.85	8.87	4.92	3.58	2.97	2.66	2.62	2.53	2.45	2.30
5	21.12	8.81	4.64	3.38	2.61	2.53	2.37	2.32	2.24	2.16
10	22.58	7.70	4.83	3.64	2.97	2.65	2.59	2.46	2.42	2.34
15	21.93	9.02	4.75	3.30	2.68	2.42	2.44	2.24	2.31	2.19
20	19.67	8.87	4.84	3.64	2.99	2.67	2.59	2.45	2.40	2.31
25	20.04	8.93	4.81	3.22	2.76	2.49	2.44	2.22	2.21	2.12
30	21.06	9.38	5.33	3.84	2.93	2.72	2.69	2.53	2.42	2.47
35	19.15	9.81	5.10	3.69	2.69	2.54	2.35	2.28	2.25	2.11
40	19.47	8.43	4.82	3.75	2.99	2.66	2.60	2.48	2.43	2.44
45	20.17	8.30	4.66	3.34	2.88	2.58	2.33	2.33	2.24	2.19
50	19.78	9.11	5.27	4.19	2.89	2.66	2.59	2.51	2.43	2.34
55	19.18	9.57	4.92	3.50	2.82	2.47	2.35	2.27	2.19	2.12
60	18.80	9.30	5.02	3.49	2.80	2.66	2.51	2.42	2.41	2.33
65	19.96	8.88	4.54	3.12	2.79	2.41	2.42	2.29	2.20	2.16
70	20.08	9.00	5.25	3.44	3.01	2.58	2.51	2.54	2.44	2.33
75	22.23	8.53	4.52	3.13	2.83	2.42	2.40	2.26	2.15	2.16
80	22.01	8.77	4.92	3.24	2.79	2.61	2.55	2.57	2.43	2.28
85	20.23	8.80	4.94	3.30	2.88	2.47	2.32	2.27	2.21	2.14
90	20.52	8.56	4.92	3.93	2.83	2.59	2.54	2.40	2.39	2.39

Table E5. Variability (standard deviation) of number of trials for H-NO-3; i.e., three congruent with half rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	45.30	13.69	6.41	3.51	2.88	2.70	2.62	2.57	2.46	2.45
-5	44.28	12.02	5.24	3.29	2.86	2.53	2.39	2.25	2.33	2.14
0	46.26	11.95	6.15	3.67	3.02	2.64	2.60	2.44	2.49	2.33
5	43.66	13.16	6.32	4.13	2.68	2.52	2.33	2.25	2.12	2.09
10	40.52	11.46	5.26	3.58	2.92	2.80	2.55	2.56	2.53	2.40
15	38.66	12.96	6.29	3.37	2.63	2.47	2.34	2.26	2.19	2.11
20	33.46	11.90	6.90	3.94	2.79	2.69	2.59	2.53	2.44	2.35
25	33.17	13.03	5.12	3.40	2.78	2.51	2.36	2.24	2.18	2.11
30	34.20	11.52	5.37	3.83	2.94	2.73	2.70	2.53	2.52	2.38
35	34.20	14.45	6.48	4.08	2.67	2.48	2.35	2.27	2.23	2.13
40	33.59	12.36	6.23	3.29	2.99	2.70	2.56	2.55	2.41	2.41
45	34.13	11.78	5.30	3.55	2.63	2.55	2.37	2.25	2.26	2.20
50	36.64	12.29	5.51	3.75	2.89	2.67	2.59	2.48	2.38	2.30
55	34.38	13.03	5.69	4.02	2.78	2.49	2.37	2.26	2.25	2.18
60	34.19	12.13	5.80	3.32	2.84	2.64	2.57	2.54	2.47	2.39
65	31.99	11.45	5.93	3.25	2.80	2.51	2.34	2.27	2.15	2.15
70	33.32	12.23	5.81	3.65	2.95	2.68	2.60	2.45	2.42	2.43
75	32.67	11.63	5.26	3.10	2.97	2.53	2.40	2.30	2.24	2.13
80	31.29	12.90	6.12	3.59	2.91	2.87	2.52	2.52	2.40	2.48
85	34.21	11.00	6.05	4.29	2.98	2.56	2.39	2.28	2.26	2.09
90	29.46	11.84	5.66	3.48	2.86	2.67	2.51	2.48	2.45	2.41

Table E6. Variability (standard deviation) of number of trials for M-MAX-3; i.e., three congruent with five ascent limit (majority rule with limit on the number of ascents), no update.

-10	210.10	15.26	8.18	5.20	3.50	3.05	2.73	2.49	2.47	2.39
-5	97.84	15.45	9.75	5.23	3.90	2.89	2.33	2.30	2.16	2.09
0	56.13	15.28	7.76	5.70	3.61	2.97	2.56	2.49	2.48	2.33
5	44.47	16.74	8.40	5.69	3.29	2.75	2.46	2.27	2.17	2.09
10	40.48	16.45	8.17	5.45	3.84	2.95	2.60	2.55	2.48	2.36
15	66.21	17.65	9.35	5.34	3.37	2.68	2.41	2.27	2.20	2.18
20	35.45	15.69	9.11	5.45	4.00	2.98	2.66	2.64	2.48	2.37
25	43.28	13.91	7.44	4.73	3.33	2.69	2.36	2.23	2.17	2.19
30	37.85	15.49	8.78	5.50	4.00	3.12	2.67	2.59	2.49	2.41
35	35.30	16.87	8.04	5.00	3.52	3.16	2.79	2.28	2.22	2.11
40	29.94	14.10	8.13	5.44	3.67	3.13	2.72	2.48	2.39	2.40
45	30.43	14.40	8.33	5.49	3.46	2.75	2.45	2.32	2.14	2.17
50	34.59	14.45	7.80	5.21	3.52	3.00	2.65	2.53	2.50	2.36
55	35.43	14.37	8.74	4.93	3.46	2.65	2.38	2.23	2.23	2.21
60	35.69	15.34	8.31	5.28	3.86	2.94	2.60	2.48	2.50	2.33
65	34.65	15.59	7.78	4.85	3.56	2.63	2.36	2.29	2.20	2.19
70	36.53	14.66	8.30	5.59	3.54	2.83	2.55	2.63	2.53	2.53
75	33.02	15.08	8.42	5.03	3.30	2.52	2.44	2.24	2.21	2.16
80	34.77	15.84	8.41	5.38	3.78	2.96	2.62	2.60	2.33	2.32
85	33.20	12.94	7.63	5.10	3.57	2.67	2.36	2.33	2.22	2.10
90	34.92	14.14	7.85	5.81	3.43	2.83	2.65	2.51	2.48	2.35

Table E7. Variability (standard deviation) of number of trials for M-NO-3; i.e., three congruent with majority rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	103.65	24.32	10.62	7.28	3.47	2.88	2.61	2.39	2.50	2.50
-5	88.22	25.59	11.13	5.96	3.45	2.78	2.35	2.34	2.22	2.14
0	99.29	20.55	10.32	5.81	3.97	2.94	2.82	2.47	2.46	2.32
5	79.10	24.96	10.51	7.07	3.91	2.55	2.44	2.30	2.19	2.14
10	73.40	23.85	10.84	6.44	4.41	3.22	2.68	2.45	2.37	2.45
15	59.35	24.09	13.98	6.35	3.80	2.94	2.27	2.41	2.15	2.20
20	58.37	21.59	12.49	6.52	4.21	3.11	2.59	2.56	2.40	2.32
25	68.81	20.45	11.33	5.51	3.82	2.64	2.31	2.58	2.16	2.23
30	70.90	24.82	11.84	5.59	4.23	2.81	2.61	2.58	2.61	2.34
35	68.64	24.43	11.29	6.10	3.60	2.92	2.38	2.25	2.22	2.18
40	57.21	23.60	10.66	5.68	3.93	2.93	2.51	2.43	2.42	2.39
45	61.48	22.00	11.60	5.98	4.01	2.69	2.32	2.26	2.25	2.17
50	61.77	25.33	11.63	6.08	3.51	2.96	2.55	2.41	2.40	2.38
55	54.59	22.11	10.87	5.06	3.25	2.66	2.47	2.28	2.10	2.17
60	59.90	24.16	10.21	6.25	3.32	2.89	2.56	2.48	2.43	2.32
65	62.30	21.58	11.14	5.95	3.79	2.69	2.41	2.31	2.19	2.15
70	53.02	23.17	10.31	5.48	3.90	3.00	2.69	2.43	2.46	2.38
75	58.19	21.12	11.10	5.94	3.73	2.60	2.37	2.33	2.24	2.17
80	59.27	22.35	10.73	6.42	4.30	2.79	2.61	2.49	2.50	2.33
85	59.12	22.25	11.36	5.67	3.85	2.88	2.36	2.32	2.18	2.09
90	62.37	22.37	10.74	6.08	3.39	2.90	3.16	2.43	2.39	2.35

Table E8. Variability (standard deviation) of number of trials for A-NO-2; i.e., first two congruent with no percent rule, no limit on number of ascents, no update.

-10	3.56	2.98	2.44	2.22	2.10	1.98	1.84	1.78	1.74	1.70
-5	3.64	2.72	2.22	1.98	1.71	1.62	1.52	1.44	1.38	1.36
0	3.62	2.82	2.53	2.19	2.14	1.92	1.82	1.74	1.71	1.66
5	3.65	2.74	2.38	1.99	1.76	1.62	1.55	1.43	1.40	1.33
10	3.55	2.77	2.52	2.25	2.12	1.90	1.86	1.82	1.72	1.72
15	3.61	2.80	2.22	1.91	1.68	1.58	1.53	1.45	1.39	1.36
20	3.70	2.98	2.45	2.25	2.01	1.93	1.82	1.82	1.71	1.73
25	3.80	2.99	2.51	2.01	1.84	1.64	1.55	1.48	1.39	1.37
30	3.57	2.97	2.53	2.31	2.13	1.87	1.87	1.78	1.76	1.61
35	3.54	2.84	2.26	1.98	1.77	1.58	1.53	1.43	1.39	1.32
40	3.75	2.86	2.43	2.32	2.11	1.94	1.87	1.79	1.76	1.72
45	3.82	2.95	2.30	2.01	1.72	1.59	1.54	1.50	1.37	1.36
50	3.79	2.87	2.35	2.13	1.94	1.94	1.74	1.68	1.63	1.53
55	3.67	2.84	2.36	1.97	1.88	1.63	1.51	1.44	1.36	1.35
60	3.76	2.82	2.31	2.12	1.89	1.77	1.72	1.64	1.58	1.56
65	3.67	2.85	2.40	1.93	1.73	1.59	1.48	1.52	1.35	1.34
70	3.57	2.78	2.34	2.10	1.97	1.80	1.76	1.77	1.61	1.56
75	3.63	2.78	2.35	2.00	1.79	1.67	1.48	1.46	1.40	1.37
80	3.57	2.72	2.32	2.11	2.01	1.88	1.71	1.62	1.59	1.54
85	3.75	2.77	2.34	2.01	1.74	1.62	1.44	1.46	1.37	1.34
90	3.59	2.75	2.32	2.06	1.94	1.85	1.75	1.67	1.63	1.59

Table E9. Variability (standard deviation) of number of trials for H-UP-2; i.e., two congruent out of last four (half rule with updates), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	4.15	2.87	2.53	2.23	2.05	1.96	1.92	1.82	1.69	1.73
-5	4.21	2.78	2.44	1.97	1.75	1.67	1.52	1.49	1.42	1.39
0	4.23	2.96	2.60	2.25	2.12	1.94	1.86	1.73	1.73	1.70
5	4.39	2.88	2.20	2.01	1.74	1.64	1.46	1.42	1.36	1.32
10	3.89	2.94	2.43	2.24	2.11	1.97	1.84	1.75	1.78	1.72
15	4.22	2.89	2.37	1.98	1.73	1.59	1.48	1.46	1.41	1.36
20	4.37	2.96	2.51	2.16	2.07	1.87	1.89	1.80	1.75	1.68
25	4.46	3.18	2.53	2.04	1.86	1.69	1.54	1.47	1.45	1.36
30	4.07	2.98	2.42	2.17	2.03	1.98	1.92	1.77	1.74	1.74
35	4.20	3.00	2.31	2.01	1.81	1.63	1.50	1.43	1.39	1.33
40	4.19	2.97	2.52	2.18	2.06	1.91	1.87	1.78	1.78	1.69
45	4.30	2.97	2.38	2.04	1.75	1.65	1.55	1.43	1.37	1.36
50	4.49	2.96	2.44	2.08	1.91	1.80	1.76	1.63	1.63	1.53
55	4.39	2.93	2.47	2.05	1.76	1.66	1.56	1.44	1.38	1.36
60	4.33	2.92	2.40	2.19	1.95	1.84	1.72	1.65	1.64	1.68
65	4.37	2.98	2.33	2.04	1.79	1.59	1.57	1.46	1.42	1.37
70	4.06	3.05	2.49	2.16	1.97	1.85	1.79	1.71	1.57	1.59
75	4.13	2.98	2.37	2.06	1.78	1.63	1.55	1.42	1.38	1.33
80	4.27	2.96	2.41	2.09	1.99	1.87	1.70	1.58	1.61	1.56
85	4.61	3.05	2.34	2.03	1.76	1.66	1.53	1.42	1.45	1.38
90	4.50	2.89	2.48	2.12	1.98	1.77	1.78	1.72	1.63	1.63

Table E10. Variability (standard deviation) of number of trials for M-UP-2; i.e., two congruent out of last three (majority rule with updates), no limit on number of ascents.

-10	5.56	4.06	2.93	2.63	2.14	2.15	1.86	1.79	1.81	1.72
-5	5.79	3.62	2.81	2.35	1.94	1.58	1.50	1.42	1.39	1.35
0	5.93	3.67	2.76	2.43	2.28	1.92	1.86	1.75	1.73	1.72
5	5.99	3.83	2.95	2.31	1.97	1.68	1.58	1.47	1.37	1.35
10	5.60	3.96	2.84	2.59	2.18	1.96	1.87	1.76	1.79	1.71
15	5.97	4.39	2.76	2.29	1.92	1.66	1.48	1.43	1.40	1.33
20	5.59	3.99	2.86	2.66	2.21	1.88	1.89	1.80	1.70	1.72
25	6.04	3.79	2.98	2.26	2.05	1.63	1.50	1.50	1.37	1.36
30	5.69	3.84	3.00	2.44	2.26	1.96	1.87	1.72	1.65	1.66
35	5.54	3.81	2.86	2.10	1.98	1.64	1.63	1.44	1.41	1.34
40	5.43	3.81	2.92	2.59	2.10	1.98	1.90	1.80	1.71	1.68
45	5.87	4.04	2.88	2.29	1.91	1.73	1.53	1.44	1.37	1.39
50	6.04	3.76	2.94	2.64	2.02	1.88	1.84	1.62	1.59	1.54
55	5.87	3.93	3.13	2.16	1.84	1.73	1.55	1.39	1.45	1.34
60	5.89	3.80	2.86	2.35	2.12	1.82	1.77	1.65	1.60	1.65
65	6.07	4.02	2.80	2.17	1.91	1.70	1.51	1.44	1.38	1.33
70	5.62	3.74	2.78	2.52	2.06	1.85	1.71	1.67	1.67	1.59
75	6.01	4.01	2.90	2.17	1.73	1.70	1.49	1.47	1.39	1.40
80	6.05	3.71	2.87	2.49	2.04	1.93	1.74	1.70	1.55	1.62
85	6.15	4.24	2.99	2.22	1.98	1.78	1.51	1.42	1.36	1.33
90	6.13	3.81	2.88	2.35	2.05	1.87	1.76	1.75	1.64	1.45

Table E11. Variability (standard deviation) of number of trials for H-MAX-2; i.e., two congruent with four ascent limit (half rule with limit on the number of ascents), no update.

dB HL	SLOPES 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	7.39	3.76	2.59	2.24	2.05	1.87	1.84	1.76	1.70	1.67
-5	7.21	3.46	2.56	1.96	1.77	1.63	1.52	1.47	1.36	1.33
0	6.38	3.36	2.63	2.24	2.07	1.95	1.85	1.80	1.72	1.70
5	5.95	3.44	2.27	2.02	1.72	1.63	1.54	1.46	1.45	1.35
10	5.63	3.41	2.54	2.25	2.09	1.97	1.84	1.81	1.75	1.66
15	5.36	3.56	2.36	1.94	1.73	1.66	1.49	1.43	1.36	1.35
20	5.90	3.68	2.51	2.31	2.08	1.97	1.84	1.75	1.70	1.71
25	5.78	3.36	2.58	2.06	1.84	1.70	1.49	1.45	1.39	1.34
30	5.87	3.45	2.64	2.27	1.96	1.90	1.86	1.81	1.76	1.63
35	6.36	3.47	2.51	1.97	1.74	1.63	1.53	1.46	1.39	1.34
40	6.21	3.54	2.62	2.24	2.05	1.91	1.85	1.79	1.72	1.71
45	6.00	3.69	2.47	1.93	1.70	1.62	1.51	1.44	1.43	1.33
50	6.05	3.36	2.53	2.18	2.01	1.85	1.78	1.76	1.64	1.58
55	5.52	3.53	2.32	2.03	1.83	1.60	1.50	1.47	1.41	1.36
60	6.04	3.26	2.68	2.17	1.89	1.78	1.73	1.70	1.65	1.60
65	6.70	3.28	2.47	2.02	1.76	1.68	1.55	1.44	1.41	1.34
70	6.05	3.41	2.42	2.11	2.05	1.85	1.69	1.72	1.58	1.58
75	6.43	3.43	2.63	1.97	1.82	1.62	1.48	1.46	1.37	1.30
80	6.51	3.41	2.59	2.17	1.99	1.92	1.76	1.70	1.68	1.56
85	6.62	3.27	2.39	2.09	1.78	1.64	1.48	1.49	1.39	1.31
90	6.09	3.44	2.41	2.15	1.96	1.79	1.72	1.67	1.62	1.52

Table E12. Variability (standard deviation) of number of trials for H-NO-2; i.e., two congruent with half rule, no limit on number of ascents, no update.

-10	18.24	6.52	3.02	2.26	2.11	1.96	1.87	1.79	1.75	1.69
-5	18.49	5.80	2.88	2.11	1.73	1.65	1.49	1.43	1.39	1.33
0	19.88	6.22	3.38	2.20	2.08	2.00	1.87	1.73	1.71	1.69
5	18.48	6.19	2.91	1.93	1.74	1.59	1.56	1.47	1.41	1.32
10	16.12	5.13	3.00	2.24	2.08	1.92	1.89	1.80	1.69	1.72
15	14.85	5.77	2.98	2.01	1.76	1.65	1.54	1.49	1.37	1.33
20	15.72	4.84	3.21	2.32	1.99	1.90	1.85	1.80	1.73	1.75
25	15.22	4.91	2.66	2.31	1.75	1.68	1.49	1.49	1.40	1.34
30	13.78	6.25	2.75	2.35	2.05	1.90	1.87	1.74	1.79	1.68
35	16.38	5.73	2.64	2.04	1.73	1.55	1.53	1.41	1.44	1.35
40	15.30	5.39	2.91	2.25	2.02	1.94	1.88	1.83	1.75	1.65
45	14.21	5.95	3.08	1.98	1.80	1.62	1.53	1.47	1.42	1.32
50	13.02	5.47	2.80	2.08	2.00	1.84	1.75	1.70	1.65	1.52
55	14.54	5.07	2.83	2.22	1.79	1.63	1.48	1.46	1.42	1.34
60	14.58	5.50	2.64	2.07	2.01	1.79	1.80	1.69	1.58	1.57
65	15.52	5.56	2.80	2.04	1.82	1.66	1.56	1.51	1.43	1.34
70	13.05	5.90	2.51	2.13	1.93	1.84	1.72	1.70	1.65	1.55
75	13.74	5.77	3.06	2.03	1.80	1.61	1.55	1.48	1.36	1.34
80	13.39	6.94	3.09	2.13	1.90	1.86	1.74	1.70	1.63	1.56
85	13.44	6.10	2.68	2.11	1.78	1.61	1.51	1.43	1.37	1.38
90	13.69	5.75	2.75	2.16	2.02	1.80	1.75	1.67	1.59	1.54

Table E13. Variability (standard deviation) of number of trials for M-MAX-2; i.e., two congruent with three ascent limit (majority rule with limit on the number of ascents), no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	45.84	6.75	4.02	3.28	2.33	2.20	1.83	1.77	1.75	1.68
-5	82.72	6.53	4.42	3.23	2.26	1.74	1.58	1.50	1.41	1.39
0	28.93	6.77	3.92	2.95	2.42	2.23	1.88	1.88	1.72	1.69
5	15.92	6.38	4.56	3.33	2.07	1.84	1.58	1.40	1.42	1.34
10	11.30	6.03	4.34	3.03	2.40	2.12	1.87	1.75	1.75	1.67
15	13.25	6.51	4.56	2.82	2.48	1.71	1.60	1.53	1.48	1.36
20	14.85	6.57	4.10	3.04	2.68	2.01	1.95	1.89	1.79	1.72
25	11.54	6.26	3.65	2.93	2.09	1.79	1.61	1.46	1.40	1.39
30	10.97	6.50	4.59	3.01	2.55	2.19	1.90	1.82	1.76	1.66
35	10.94	5.86	4.23	3.07	2.57	1.79	1.58	1.53	1.40	1.31
40	12.09	6.26	4.04	3.50	2.41	2.13	1.85	1.82	1.80	1.71
45	10.63	5.43	3.92	3.11	2.15	1.79	1.66	1.47	1.40	1.34
50	10.36	6.58	4.40	3.32	2.51	2.03	1.78	1.67	1.61	1.60
55	10.42	6.36	3.90	3.00	2.21	1.98	1.66	1.49	1.36	1.33
60	11.93	7.15	4.11	3.27	2.40	2.03	1.85	1.68	1.70	1.54
65	10.55	6.28	4.01	2.91	2.31	1.80	1.53	1.48	1.37	1.35
70	11.49	6.69	4.55	3.08	2.41	2.00	1.94	1.63	1.66	1.58
75	9.74	6.46	4.30	3.06	2.22	1.97	1.54	1.52	1.42	1.37
80	11.53	6.93	4.28	2.77	2.33	1.89	1.67	1.68	1.61	1.58
85	11.84	6.50	3.94	2.92	2.12	1.81	1.56	1.48	1.41	1.34
90	11.35	6.22	4.08	3.22	2.52	1.90	1.86	1.68	1.68	1.58

Table E14. Variability (standard deviation) of number of trials for M-NO-2; i.e., two congruent with majority rule, no limit on number of ascents, no update.

-10	51.48	15.92	7.83	4.56	2.86	2.23	1.94	1.81	1.74	1.70
-5	80.96	15.33	8.93	4.75	2.82	2.17	1.61	1.50	1.37	1.37
0	44.91	14.29	8.62	4.89	3.02	2.21	1.95	1.77	1.66	1.72
5	44.50	15.05	8.96	4.50	3.05	1.64	1.58	1.45	1.44	1.34
10	38.42	15.03	8.20	4.75	3.53	2.19	2.01	1.80	1.80	1.66
15	33.55	15.86	7.80	4.02	3.23	1.73	1.88	1.41	1.42	1.32
20	37.42	13.88	7.92	4.44	2.91	2.17	1.91	1.86	1.79	1.65
25	34.62	12.53	7.56	4.76	2.62	1.77	1.62	1.54	1.43	1.34
30	31.76	14.68	8.03	4.89	3.19	2.19	1.89	1.80	1.73	1.77
35	31.06	14.73	7.42	5.06	2.40	1.87	1.82	1.58	1.39	1.36
40	31.81	14.48	7.45	4.55	2.72	2.11	2.19	1.78	1.78	1.74
45	29.05	13.28	6.71	4.44	3.07	1.71	1.54	1.47	1.41	1.36
50	29.66	14.38	8.15	4.34	2.76	2.21	1.81	1.64	1.54	1.57
55	31.03	13.18	7.58	5.33	2.42	1.82	1.56	1.46	1.36	1.33
60	31.50	15.31	8.57	4.79	3.19	2.03	1.82	1.73	1.70	1.53
65	29.14	14.25	7.40	4.18	3.33	1.81	1.67	1.52	1.39	1.34
70	28.25	13.20	7.50	5.06	3.49	2.04	1.91	1.72	1.65	1.50
75	32.02	13.69	7.98	3.41	2.54	2.31	1.83	1.51	1.44	1.40
80	28.77	14.77	7.48	3.63	2.51	2.11	1.73	1.68	1.59	1.53
85	29.82	13.08	7.03	4.47	2.75	1.89	1.52	1.41	1.37	1.35
90	32.01	13.64	7.71	4.36	2.60	1.98	1.91	1.75	1.62	1.59

Appendix F. Average Number of Ascents Required for Threshold

Table F1. Average number of ascents in threshold estimates for A-NO-3: i.e., first three congruent with no percent rule, no limit on number of ascents, no update.

	SLOPES									
dB Hl	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	6.51	5.22	4.53	4.18	3.91	3.79	3.65	3.56	3.52	3.51
-5	6.44	5.25	4.51	4.14	3.94	3.80	3.66	3.58	3.51	3.46
0	6.59	5.15	4.57	4.20	3.94	3.76	3.66	3.58	3.51	3.42
5	6.39	5.12	4.56	4.18	3.93	3.73	3.67	3.58	3.53	3.46
10	6.45	5.21	4.50	4.20	3.93	3.76	3.65	3.59	3.51	3.46
15	6.42	5.19	4.53	4.20	3.94	3.76	3.68	3.60	3.49	3.50
20	6.33	5.21	4.55	4.15	3.92	3.73	3.65	3.57	3.48	3.43
25	6.30	5.07	4.50	4.15	3.89	3.75	3.59	3.61	3.51	3.46
30	6.32	5.07	4.49	4.15	3.89	3.74	3.64	3.53	3.51	3.42
35	6.39	5.20	4.51	4.18	3.98	3.80	3.67	3.55	3.55	3.45
40	6.32	5.18	4.57	4.20	3.90	3.75	3.64	3.58	3.53	3.49
45	6.18	5.05	4.48	4.16	3.92	3.74	3.62	3.59	3.52	3.45
50	6.25	5.16	4.56	4.16	3.92	3.69	3.63	3.57	3.47	3.45
55	6.30	5.06	4.46	4.16	3.93	3.78	3.67	3.57	3.54	3.45
60	6.23	5.14	4.55	4.08	3.96	3.75	3.61	3.51	3.50	3.44
65	6.20	5.02	4.45	4.13	3.93	3.73	3.64	3.53	3.52	3.48
70	6.36	5.11	4.51	4.20	3.94	3.72	3.63	3.55	3.49	3.43
75	6.25	5.06	4.45	4.18	3.93	3.75	3.65	3.55	3.52	3.43
80	6.22	5.07	4.51	4.15	3.87	3.77	3.63	3.55	3.46	3.43
85	6.22	5.07	4.44	4.13	3.93	3.74	3.66	3.58	3.52	3.46
90	6.20	5.11	4.60	4.13	3.90	3.74	3.64	3.58	3.46	3.45

Table F2. Average number of ascents in threshold estimates for H-UP-3: i.e., three congruent out of last six (half rule with updates), no limit on number of ascents.

-10	7.35	5.40	4.64	4.17	3.90	3.76	3.66	3.53	3.54	3.47
-5	7.21	5.35	4.53	4.14	3.93	3.81	3.65	3.58	3.49	3.44
0	7.24	5.33	4.59	4.16	3.92	3.76	3.68	3.59	3.48	3.46
5	7.18	5.37	4.61	4.22	3.92	3.78	3.61	3.55	3.51	3.47
10	7.15	5.33	4.61	4.23	3.95	3.80	3.66	3.57	3.53	3.45
15	7.06	5.26	4.59	4.19	3.91	3.77	3.67	3.58	3.52	3.48
20	6.93	5.33	4.51	4.24	3.87	3.77	3.69	3.56	3.52	3.46
25	6.96	5.17	4.53	4.15	3.89	3.73	3.66	3.58	3.52	3.45
30	7.12	5.26	4.53	4.07	3.94	3.74	3.62	3.54	3.50	3.42
35	6.86	5.33	4.53	4.24	3.98	3.76	3.65	3.57	3.51	3.47
40	6.95	5.29	4.55	4.20	3.92	3.80	3.67	3.57	3.50	3.46
45	6.90	5.21	4.53	4.16	3.93	3.77	3.65	3.55	3.54	3.49
50	7.04	5.26	4.51	4.18	3.88	3.78	3.62	3.56	3.48	3.44
55	7.08	5.24	4.51	4.15	3.99	3.79	3.64	3.57	3.51	3.45
60	6.91	5.30	4.53	4.20	3.91	3.76	3.59	3.56	3.48	3.43
65	6.97	5.17	4.53	4.14	3.89	3.74	3.68	3.58	3.54	3.44
70	6.97	5.26	4.54	4.16	3.96	3.74	3.63	3.55	3.45	3.44
75	6.93	5.27	4.51	4.15	3.92	3.76	3.64	3.56	3.51	3.45
80	6.79	5.34	4.56	4.17	3.90	3.73	3.61	3.54	3.50	3.42
85	6.94	5.16	4.55	4.17	3.90	3.74	3.67	3.54	3.54	3.45
90	6.96	5.31	4.55	4.19	3.89	3.75	3.63	3.57	3.48	3.44

Table F3. Average number of ascents in threshold estimates for M-UP-3: i.e., three congruent out of last five (majority rule with updates), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	8.60	5.75	4.69	4.30	3.92	3.77	3.63	3.58	3.52	3.46
-5	8.28	5.68	4.75	4.27	4.00	3.77	3.65	3.57	3.49	3.46
0	8.23	5.63	4.75	4.21	3.92	3.74	3.66	3.54	3.51	3.45
5	8.25	5.67	4.77	4.15	4.01	3.79	3.64	3.59	3.49	3.43
10	8.19	5.70	4.74	4.24	3.97	3.80	3.65	3.59	3.55	3.45
15	8.19	5.61	4.79	4.22	3.97	3.78	3.63	3.61	3.54	3.50
20	8.30	5.61	4.70	4.32	3.92	3.80	3.63	3.59	3.53	3.48
25	8.05	5.56	4.70	4.16	3.93	3.77	3.64	3.53	3.51	3.44
30	8.09	5.74	4.76	4.22	3.97	3.74	3.64	3.52	3.47	3.44
35	8.51	5.74	4.74	4.24	3.97	3.79	3.67	3.60	3.49	3.44
40	8.22	5.66	4.74	4.25	3.99	3.80	3.63	3.58	3.51	3.46
45	8.17	5.47	4.62	4.25	4.00	3.80	3.66	3.55	3.49	3.41
50	8.04	5.61	4.70	4.11	3.93	3.74	3.69	3.55	3.49	3.45
55	8.12	5.71	4.70	4.23	3.92	3.81	3.68	3.57	3.52	3.39
60	8.00	5.60	4.70	4.30	3.89	3.74	3.63	3.57	3.54	3.42
65	8.15	5.53	4.64	4.22	3.97	3.80	3.67	3.61	3.49	3.48
70	8.07	5.64	4.68	4.27	3.91	3.77	3.65	3.55	3.49	3.46
75	7.97	5.63	4.81	4.24	3.88	3.74	3.68	3.54	3.52	3.47
80	8.11	5.66	4.73	4.20	3.92	3.73	3.62	3.55	3.50	3.44
85	8.26	5.53	4.73	4.17	3.93	3.76	3.63	3.63	3.49	3.46
90	8.16	5.57	4.72	4.23	3.88	3.74	3.66	3.55	3.47	3.43

Table F4. Average number of ascents in threshold estimates for H-MAX-3: i.e., three congruent with six ascent limit (half rule with limit on the number of ascents), no update.

-10	5.08	4.79	4.48	4.14	3.95	3.78	3.67	3.58	3.50	3.44
-5	5.05	4.73	4.40	4.18	3.89	3.77	3.68	3.59	3.52	3.47
0	5.06	4.71	4.41	4.11	3.90	3.80	3.63	3.60	3.50	3.44
5	5.05	4.76	4.41	4.16	3.92	3.78	3.68	3.60	3.52	3.46
10	5.06	4.77	4.42	4.17	3.97	3.77	3.69	3.58	3.51	3.43
15	5.06	4.73	4.44	4.14	3.91	3.72	3.69	3.54	3.53	3.48
20	5.00	4.73	4.45	4.07	3.94	3.79	3.64	3.55	3.49	3.43
25	4.97	4.69	4.36	4.15	3.86	3.80	3.68	3.52	3.50	3.44
30	5.00	4.71	4.43	4.15	3.89	3.76	3.62	3.50	3.45	3.43
35	5.03	4.76	4.47	4.09	3.88	3.80	3.65	3.57	3.54	3.45
40	4.99	4.67	4.42	4.11	3.93	3.77	3.66	3.56	3.51	3.48
45	4.92	4.68	4.39	4.08	3.89	3.77	3.61	3.58	3.52	3.47
50	4.91	4.70	4.45	4.15	3.90	3.70	3.63	3.57	3.51	3.43
55	4.97	4.67	4.41	4.10	3.92	3.74	3.66	3.59	3.53	3.44
60	4.97	4.68	4.39	4.11	3.90	3.71	3.62	3.52	3.47	3.44
65	4.92	4.70	4.40	4.09	3.86	3.71	3.68	3.56	3.53	3.49
70	4.90	4.69	4.34	4.09	3.89	3.72	3.66	3.53	3.53	3.44
75	4.91	4.68	4.42	4.11	3.84	3.77	3.67	3.57	3.48	3.46
80	5.00	4.72	4.43	4.12	3.92	3.73	3.62	3.52	3.51	3.40
85	4.94	4.73	4.35	4.10	3.91	3.75	3.63	3.59	3.50	3.48
90	4.90	4.70	4.36	4.16	3.85	3.76	3.62	3.52	3.51	3.45

Table F5. Average number of ascents in threshold estimates for H-NO-3: i.e.. three congruent with half rule. no limit on number of ascents. no update.

					SLOPES					
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	5.61	5.15	4.59	4.23	3.94	3.79	3.66	3.58	3.51	3.46
-5	5.59	5.13	4.65	4.21	3.94	3.81	3.69	3.55	3.55	3.46
0	5.60	5.12	4.62	4.22	3.93	3.75	3.64	3.57	3.52	3.42
5	5.60	5.09	4.51	4.26	3.93	3.78	3.67	3.55	3.47	3.44
10	5.58	5.08	4.53	4.19	3.92	3.78	3.63	3.56	3.53	3.43
15	5.49	5.17	4.67	4.26	3.95	3.78	3.66	3.54	3.51	3.43
20	5.53	5.14	4.58	4.22	3.95	3.81	3.69	3.56	3.53	3.44
25	5.39	5.06	4.49	4.22	3.95	3.79	3.65	3.57	3.50	3.45
30	5.60	5.09	4.52	4.12	3.94	3.73	3.62	3.54	3.48	3.42
35	5.58	5.14	4.61	4.29	3.94	3.80	3.68	3.56	3.53	3.45
40	5.38	5.09	4.64	4.18	3.97	3.78	3.68	3.60	3.50	3.46
45	5.47	5.09	4.50	4.14	3.87	3.78	3.68	3.56	3.53	3.46
50	5.40	5.00	4.51	4.16	3.95	3.78	3.65	3.54	3.49	3.44
55	5.49	5.08	4.51	4.18	3.91	3.80	3.63	3.58	3.52	3.44
60	5.44	5.01	4.55	4.23	3.96	3.75	3.64	3.54	3.48	3.46
65	5.42	5.02	4.49	4.16	3.93	3.77	3.64	3.56	3.52	3.45
70	5.50	4.99	4.61	4.23	3.90	3.72	3.63	3.53	3.49	3.42
75	5.38	5.08	4.41	4.13	3.88	3.76	3.70	3.56	3.50	3.44
80	5.49	5.08	4.62	4.18	3.90	3.69	3.66	3.54	3.49	3.43
85	5.48	4.98	4.56	4.14	3.90	3.78	3.65	3.58	3.53	3.43
90	5.41	5.10	4.53	4.18	3.95	3.75	3.63	3.56	3.50	3.42

Table F6. Average number of ascents in threshold estimates for M-MAX-3: i.e.. three congruent with five ascent limit (majority rule with limit on the number of ascents). no update.

-10	4.41	4.25	4.12	3.99	3.87	3.75	3.63	3.55	3.48	3.44
-5	4.45	4.27	4.14	4.01	3.83	3.74	3.64	3.56	3.47	3.45
0	4.43	4.29	4.11	4.00	3.89	3.77	3.65	3.56	3.52	3.46
5	4.42	4.26	4.11	4.00	3.87	3.74	3.64	3.59	3.48	3.43
10	4.42	4.27	4.10	3.99	3.87	3.73	3.64	3.59	3.51	3.45
15	4.39	4.27	4.10	4.02	3.86	3.72	3.63	3.61	3.49	3.47
20	4.40	4.28	4.14	3.98	3.85	3.73	3.65	3.57	3.52	3.45
25	4.36	4.18	4.09	3.99	3.87	3.73	3.68	3.56	3.50	3.48
30	4.39	4.23	4.14	3.94	3.86	3.73	3.65	3.58	3.49	3.39
35	4.39	4.32	4.10	3.95	3.86	3.78	3.63	3.55	3.53	3.45
40	4.35	4.27	4.11	3.97	3.87	3.73	3.62	3.53	3.47	3.47
45	4.36	4.24	4.11	3.95	3.87	3.76	3.64	3.59	3.50	3.46
50	4.35	4.23	4.11	3.96	3.80	3.70	3.60	3.55	3.47	3.44
55	4.35	4.26	4.13	3.95	3.86	3.67	3.64	3.56	3.52	3.48
60	4.37	4.22	4.10	3.98	3.83	3.73	3.59	3.53	3.51	3.41
65	4.38	4.21	4.10	3.93	3.85	3.74	3.64	3.57	3.50	3.46
70	4.36	4.26	4.08	3.98	3.85	3.71	3.60	3.59	3.50	3.45
75	4.32	4.23	4.13	3.98	3.89	3.69	3.64	3.55	3.52	3.46
80	4.34	4.25	4.09	4.02	3.85	3.73	3.60	3.57	3.46	3.42
85	4.33	4.21	4.09	3.99	3.82	3.75	3.63	3.55	3.52	3.43
90	4.32	4.28	4.13	3.98	3.87	3.69	3.64	3.53	3.51	3.40

Table F7. Average number of ascents in threshold estimates for M-NO-3: i.e., three congruent with majority rule, no limit on number of ascents, no update.

	SLOPES									
dB Hl	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	5.30	5.12	4.64	4.30	4.01	3.78	3.66	3.53	3.51	3.49
-5	5.34	5.10	4.60	4.34	3.95	3.76	3.67	3.55	3.51	3.45
0	5.26	5.07	4.75	4.24	3.98	3.79	3.67	3.59	3.51	3.43
5	5.34	5.10	4.70	4.25	4.00	3.77	3.67	3.54	3.51	3.45
10	5.24	5.12	4.70	4.38	3.97	3.84	3.68	3.59	3.49	3.48
15	5.17	5.04	4.72	4.33	4.04	3.79	3.65	3.59	3.50	3.47
20	5.18	5.08	4.68	4.29	3.99	3.80	3.64	3.59	3.50	3.43
25	5.18	4.90	4.63	4.22	3.94	3.74	3.66	3.61	3.51	3.47
30	5.18	5.01	4.72	4.27	3.95	3.74	3.62	3.53	3.51	3.41
35	5.19	5.27	4.70	4.23	3.96	3.79	3.65	3.59	3.48	3.47
40	5.26	5.03	4.74	4.20	4.00	3.82	3.67	3.58	3.50	3.47
45	5.20	4.96	4.64	4.19	3.96	3.80	3.62	3.56	3.50	3.47
50	5.10	5.12	4.66	4.24	3.93	3.72	3.60	3.55	3.50	3.45
55	5.17	4.97	4.65	4.24	3.92	3.76	3.64	3.57	3.47	3.47
60	5.22	5.06	4.65	4.27	3.88	3.78	3.65	3.53	3.48	3.41
65	5.17	4.97	4.70	4.29	3.96	3.80	3.68	3.57	3.53	3.46
70	5.12	5.05	4.63	4.24	3.92	3.75	3.63	3.54	3.52	3.46
75	5.04	5.05	4.60	4.27	3.92	3.75	3.63	3.60	3.52	3.47
80	5.06	5.01	4.66	4.24	3.96	3.77	3.65	3.55	3.51	3.42
85	5.11	4.92	4.69	4.18	4.02	3.76	3.67	3.58	3.50	3.45
90	5.10	5.01	4.64	4.23	3.92	3.76	3.65	3.52	3.49	3.44

Table F8. Average number of ascents in threshold estimates for A-NO-2: i.e., first two congruent with no percent rule, no limit on number of ascents, no update.

-10	3.59	3.04	2.74	2.59	2.44	2.37	2.33	2.28	2.26	2.23
-5	3.64	3.05	2.74	2.57	2.44	2.38	2.32	2.29	2.26	2.23
0	3.61	3.03	2.72	2.55	2.44	2.39	2.33	2.28	2.22	2.21
5	3.62	3.02	2.76	2.58	2.47	2.36	2.33	2.27	2.25	2.23
10	3.57	2.99	2.78	2.55	2.45	2.35	2.32	2.30	2.25	2.23
15	3.48	3.06	2.70	2.59	2.43	2.38	2.32	2.27	2.24	2.23
20	3.47	3.01	2.73	2.60	2.44	2.38	2.32	2.28	2.24	2.24
25	3.43	2.94	2.73	2.57	2.45	2.34	2.33	2.29	2.24	2.22
30	3.43	3.01	2.72	2.55	2.44	2.37	2.31	2.27	2.21	2.20
35	3.47	3.03	2.71	2.58	2.46	2.36	2.34	2.25	2.25	2.21
40	3.44	2.99	2.73	2.58	2.46	2.40	2.33	2.29	2.28	2.24
45	3.37	2.98	2.70	2.54	2.42	2.35	2.33	2.31	2.25	2.23
50	3.44	2.94	2.75	2.54	2.41	2.38	2.31	2.25	2.24	2.20
55	3.38	2.91	2.69	2.49	2.45	2.39	2.33	2.30	2.24	2.21
60	3.47	2.95	2.72	2.53	2.42	2.34	2.29	2.25	2.23	2.23
65	3.45	2.95	2.70	2.50	2.42	2.36	2.30	2.31	2.23	2.23
70	3.37	2.94	2.70	2.54	2.46	2.36	2.30	2.27	2.25	2.21
75	3.41	2.91	2.71	2.56	2.45	2.39	2.30	2.29	2.25	2.23
80	3.40	2.96	2.67	2.50	2.44	2.36	2.29	2.26	2.23	2.21
85	3.44	2.96	2.68	2.51	2.46	2.36	2.28	2.29	2.25	2.23
90	3.41	2.96	2.72	2.55	2.43	2.39	2.29	2.28	2.24	2.20

Table F9. Average number of ascents in threshold estimates for H-Up-2: i.e., two congruent out of last four (half rule with updates), no limit on number of ascents.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	3.68	3.05	2.74	2.58	2.46	2.39	2.34	2.27	2.25	2.24
-5	3.74	2.99	2.74	2.57	2.46	2.38	2.32	2.30	2.27	2.24
0	3.72	3.01	2.73	2.55	2.47	2.37	2.33	2.25	2.24	2.22
5	3.76	3.08	2.69	2.59	2.43	2.38	2.30	2.27	2.23	2.21
10	3.61	2.97	2.74	2.57	2.47	2.38	2.32	2.24	2.25	2.24
15	3.60	3.01	2.73	2.54	2.44	2.38	2.33	2.28	2.25	2.23
20	3.55	2.99	2.73	2.52	2.41	2.38	2.33	2.28	2.24	2.22
25	3.56	2.98	2.69	2.51	2.43	2.39	2.32	2.29	2.27	2.24
30	3.49	3.02	2.73	2.55	2.42	2.36	2.34	2.27	2.23	2.22
35	3.52	3.02	2.75	2.57	2.48	2.38	2.31	2.26	2.26	2.22
40	3.57	3.00	2.77	2.55	2.46	2.37	2.32	2.28	2.26	2.24
45	3.54	2.94	2.67	2.54	2.43	2.40	2.35	2.27	2.24	2.22
50	3.55	2.97	2.72	2.55	2.44	2.35	2.29	2.25	2.24	2.20
55	3.49	2.96	2.69	2.55	2.43	2.38	2.35	2.28	2.24	2.23
60	3.51	2.92	2.74	2.57	2.44	2.36	2.29	2.26	2.22	2.22
65	3.57	2.92	2.69	2.56	2.43	2.34	2.34	2.27	2.26	2.22
70	3.49	2.99	2.70	2.55	2.43	2.36	2.32	2.27	2.23	2.20
75	3.44	2.99	2.68	2.54	2.45	2.38	2.32	2.26	2.25	2.21
80	3.49	3.01	2.72	2.55	2.45	2.39	2.30	2.26	2.22	2.20
85	3.51	3.03	2.70	2.51	2.43	2.39	2.33	2.28	2.26	2.24
90	3.49	2.99	2.74	2.54	2.42	2.35	2.29	2.27	2.24	2.22

Table F10. Average number of ascents in threshold estimates for M-UP-2: i.e., two congruent out of last three (majority rule with updates), no limit on number of ascents.

-10	4.03	3.20	2.82	2.64	2.47	2.39	2.33	2.31	2.26	2.23
-5	4.06	3.17	2.80	2.63	2.49	2.37	2.31	2.28	2.24	2.22
0	4.02	3.16	2.74	2.56	2.49	2.39	2.31	2.27	2.24	2.22
5	4.04	3.21	2.84	2.60	2.47	2.39	2.34	2.29	2.23	2.22
10	3.88	3.18	2.77	2.61	2.45	2.37	2.33	2.28	2.24	2.22
15	3.91	3.28	2.81	2.61	2.47	2.36	2.31	2.28	2.27	2.22
20	3.73	3.17	2.79	2.63	2.47	2.35	2.32	2.28	2.26	2.23
25	3.83	3.05	2.77	2.58	2.45	2.37	2.33	2.28	2.25	2.23
30	3.83	3.14	2.78	2.60	2.46	2.35	2.30	2.25	2.22	2.19
35	3.87	3.14	2.83	2.54	2.46	2.38	2.35	2.28	2.27	2.22
40	3.80	3.18	2.79	2.60	2.50	2.39	2.32	2.29	2.24	2.22
45	3.87	3.16	2.77	2.56	2.46	2.40	2.32	2.27	2.23	2.24
50	3.78	3.13	2.82	2.63	2.44	2.36	2.33	2.24	2.21	2.22
55	3.90	3.12	2.78	2.51	2.48	2.37	2.33	2.26	2.26	2.23
60	3.86	3.10	2.76	2.57	2.44	2.34	2.30	2.26	2.23	2.22
65	3.90	3.10	2.71	2.54	2.45	2.37	2.31	2.30	2.24	2.22
70	3.81	3.10	2.80	2.59	2.47	2.36	2.30	2.25	2.23	2.20
75	3.89	3.14	2.74	2.54	2.41	2.39	2.30	2.28	2.25	2.22
80	3.80	3.09	2.76	2.62	2.45	2.38	2.29	2.28	2.23	2.24
85	3.86	3.15	2.81	2.58	2.44	2.40	2.32	2.27	2.25	2.23
90	3.81	3.13	2.77	2.58	2.42	2.39	2.29	2.24	2.24	2.19

Table F11. Average number of ascents in threshold estimates for H-MAX-2: i.e., two congruent with four ascent limit (half rule with limit on the number of ascents), no update.

					SLOPES					
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	3.17	2.91	2.74	2.59	2.45	2.38	2.31	2.28	2.24	2.23
-5	3.18	2.91	2.76	2.56	2.45	2.38	2.31	2.29	2.23	2.22
0	3.16	2.92	2.78	2.59	2.46	2.37	2.31	2.30	2.25	2.21
5	3.13	2.91	2.71	2.57	2.44	2.40	2.33	2.28	2.28	2.22
10	3.12	2.93	2.75	2.58	2.46	2.36	2.33	2.30	2.27	2.21
15	3.12	2.91	2.70	2.57	2.42	2.41	2.32	2.27	2.24	2.23
20	3.05	2.94	2.73	2.59	2.44	2.41	2.32	2.28	2.25	2.23
25	3.09	2.89	2.66	2.59	2.44	2.37	2.30	2.29	2.26	2.22
30	3.08	2.88	2.70	2.55	2.43	2.34	2.29	2.27	2.23	2.19
35	3.13	2.88	2.73	2.54	2.46	2.39	2.31	2.30	2.25	2.24
40	3.08	2.90	2.70	2.57	2.46	2.36	2.34	2.29	2.25	2.22
45	3.06	2.81	2.69	2.51	2.42	2.38	2.32	2.29	2.29	2.22
50	3.04	2.89	2.73	2.56	2.47	2.36	2.30	2.27	2.23	2.21
55	3.06	2.86	2.71	2.53	2.44	2.38	2.31	2.29	2.26	2.23
60	3.06	2.85	2.74	2.55	2.46	2.33	2.29	2.26	2.24	2.20
65	3.10	2.86	2.65	2.52	2.42	2.36	2.33	2.26	2.26	2.22
70	3.05	2.90	2.69	2.54	2.44	2.36	2.29	2.28	2.21	2.21
75	3.11	2.88	2.71	2.53	2.44	2.35	2.29	2.30	2.24	2.20
80	3.04	2.90	2.70	2.57	2.43	2.39	2.29	2.26	2.25	2.21
85	3.06	2.87	2.68	2.54	2.43	2.37	2.31	2.29	2.25	2.21
90	3.05	2.90	2.71	2.56	2.45	2.37	2.29	2.27	2.23	2.20

Table F12. Average number of ascents in threshold estimates for H-NO-2: i.e., two congruent with hlaf rule, no limit on number of ascents, no update.

-10	3.48	2.97	2.74	2.57	2.45	2.36	2.33	2.29	2.27	2.22
-5	3.50	2.99	2.72	2.58	2.41	2.37	2.32	2.27	2.25	2.21
0	3.51	3.00	2.74	2.54	2.47	2.39	2.34	2.27	2.24	2.21
5	3.49	3.07	2.72	2.58	2.45	2.38	2.35	2.29	2.26	2.20
10	3.51	3.03	2.70	2.56	2.46	2.39	2.32	2.29	2.24	2.23
15	3.41	3.03	2.72	2.56	2.45	2.40	2.34	2.32	2.24	2.22
20	3.36	3.03	2.71	2.59	2.44	2.37	2.31	2.30	2.25	2.23
25	3.34	2.91	2.68	2.52	2.42	2.38	2.31	2.28	2.26	2.23
30	3.34	3.07	2.74	2.55	2.43	2.36	2.31	2.25	2.24	2.21
35	3.38	3.02	2.73	2.57	2.44	2.37	2.33	2.29	2.26	2.22
40	3.43	3.01	2.75	2.58	2.44	2.36	2.30	2.28	2.27	2.22
45	3.28	2.91	2.70	2.53	2.43	2.40	2.33	2.28	2.26	2.21
50	3.28	3.01	2.72	2.56	2.44	2.36	2.30	2.27	2.24	2.21
55	3.32	3.00	2.71	2.56	2.43	2.39	2.31	2.28	2.27	2.22
60	3.31	3.00	2.73	2.55	2.44	2.38	2.30	2.28	2.23	2.19
65	3.30	3.03	2.68	2.54	2.43	2.38	2.33	2.31	2.27	2.21
70	3.30	3.02	2.71	2.55	2.45	2.36	2.30	2.26	2.23	2.21
75	3.29	2.96	2.68	2.55	2.45	2.36	2.31	2.31	2.23	2.22
80	3.25	3.07	2.70	2.57	2.42	2.38	2.29	2.26	2.24	2.21
85	3.31	2.99	2.70	2.55	2.45	2.38	2.31	2.27	2.23	2.24
90	3.31	2.96	2.73	2.55	2.44	2.35	2.33	2.25	2.22	2.21

Table F13. Average number of ascents in threshold estimates for M-MAX-2: i.e., two congruent with three ascent limit (majority rule with limit on the number of ascents), no update.

dB Hl	SLOPES 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	2.69	2.58	2.53	2.47	2.41	2.35	2.31	2.28	2.26	2.23
-5	2:63	2.60	2.53	2.43	2.41	2.35	2.30	2.28	2.26	2.25
0	2.65	2.58	2.53	2.44	2.42	2.35	2.33	2.29	2.24	2.23
5	2.67	2.58	2.52	2.49	2.42	2.36	2.30	2.26	2.27	2.23
10	2.63	2.62	2.54	2.45	2.38	2.35	2.31	2.27	2.26	2.23
15	2.64	2.56	2.50	2.48	2.43	2.35	2.32	2.27	2.28	2.24
20	2.62	2.56	2.52	2.48	2.41	2.34	2.34	2.31	2.24	2.24
25	2.62	2.54	2.46	2.44	2.39	2.35	2.31	2.27	2.25	2.25
30	2.62	2.56	2.50	2.42	2.38	2.33	2.31	2.28	2.24	2.22
35	2.58	2.58	2.51	2.46	2.42	2.37	2.31	2.29	2.24	2.21
40	2.62	2.57	2.54	2.43	2.42	2.35	2.31	2.27	2.27	2.25
45	2.62	2.53	2.47	2.43	2.41	2.35	2.32	2.29	2.26	2.21
50	2.60	2.56	2.52	2.42	2.39	2.34	2.30	2.26	2.22	2.20
55	2.62	2.57	2.49	2.47	2.37	2.34	2.29	2.28	2.25	2.22
60	2.63	2.56	2.51	2.47	2.40	2.34	2.30	2.25	2.23	2.20
65	2.60	2.54	2.50	2.45	2.40	2.36	2.33	2.30	2.23	2.22
70	2.59	2.57	2.54	2.46	2.39	2.35	2.29	2.25	2.23	2.21
75	2.60	2.58	2.52	2.46	2.43	2.34	2.31	2.29	2.27	2.23
80	2.59	2.57	2.48	2.43	2.38	2.35	2.26	2.26	2.22	2.22
85	2.58	2.55	2.52	2.41	2.41	2.34	2.32	2.25	2.25	2.21
90	2.60	2.59	2.47	2.45	2.38	2.33	2.32	2.26	2.24	2.21

Table F14. Average number of ascents in threshold estimates for MNO-2: i.e., two congruent with majority rule, no limit on number of ascents, no update.

-10	3.47	3.22	2.92	2.70	2.50	2.41	2.34	2.29	2.25	2.23
-5	3.41	3.28	2.98	2.79	2.50	2.40	2.33	2.31	2.23	2.23
0	3.56	3.31	3.07	2.77	2.53	2.42	2.33	2.29	2.25	2.22
5	3.43	3.37	2.94	2.71	2.56	2.37	2.33	2.29	2.27	2.23
10	3.42	3.26	2.90	2.72	2.58	2.39	2.34	2.28	2.25	2.22
15	3.30	3.24	3.02	2.67	2.50	2.40	2.31	2.26	2.26	2.21
20	3.33	3.26	2.96	2.70	2.51	2.40	2.32	2.30	2.26	2.20
25	3.21	3.19	2.98	2.68	2.46	2.40	2.33	2.29	2.27	2.22
30	3.19	3.17	3.07	2.68	2.51	2.40	2.31	2.27	2.25	2.24
35	3.27	3.28	3.01	2.78	2.50	2.40	2.33	2.29	2.26	2.24
40	3.28	3.24	2.99	2.73	2.45	2.38	2.33	2.29	2.27	2.22
45	3.26	3.21	2.93	2.63	2.54	2.37	2.34	2.29	2.25	2.23
50	3.16	3.31	2.99	2.73	2.46	2.38	2.29	2.28	2.21	2.21
55	3.30	3.05	2.94	2.64	2.46	2.40	2.32	2.30	2.23	2.20
60	3.20	3.15	3.00	2.67	2.46	2.38	2.32	2.27	2.23	2.20
65	3.18	3.22	2.95	2.62	2.48	2.36	2.31	2.28	2.26	2.22
70	3.21	3.15	2.98	2.71	2.49	2.35	2.31	2.27	2.23	2.19
75	3.18	3.17	2.92	2.60	2.50	2.40	2.36	2.32	2.26	2.23
80	3.25	3.14	2.89	2.64	2.44	2.38	2.28	2.24	2.23	2.20
85	3.17	3.09	2.91	2.69	2.51	2.41	2.30	2.27	2.24	2.21
90	3.28	3.23	2.90	2.71	2.51	2.35	2.31	2.29	2.22	2.21

Appendix G. Proportion of Threshold Determinations Repeated One or More Times

Table G1. Proportion of Repeated Threshold Determinations for A-NO-3; i.e., first three congruent with no percent rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table G2. Proportion of Repeated Threshold Determinations for H-UP-3; i.e., three congruent out of last six (half rule with updates), no limit on number of ascents.

-10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table G7. Proportion of Repeated Threshold Determinations for M-NO-3; i.e., thre congruent with majority rule, no limit on number of ascents, no update.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	0.582	0.229	0.072	0.027	0.001	0.000	0.000	0.000	0.000	0.000
-5	0.603	0.234	0.067	0.012	0.003	0.001	0.000	0.000	0.000	0.000
0	0.575	0.232	0.058	0.015	0.004	0.001	0.000	0.000	0.000	0.000
5	0.552	0.244	0.068	0.027	0.004	0.000	0.000	0.000	0.000	0.000
10	0.582	0.231	0.076	0.016	0.005	0.001	0.000	0.000	0.000	0.000
15	0.542	0.222	0.083	0.020	0.003	0.001	0.000	0.000	0.000	0.000
20	0.572	0.220	0.091	0.018	0.005	0.001	0.000	0.000	0.000	0.000
25	0.550	0.226	0.072	0.012	0.004	0.000	0.000	0.001	0.000	0.000
30	0.551	0.247	0.073	0.011	0.005	0.000	0.000	0.000	0.000	0.000
35	0.553	0.266	0.074	0.019	0.002	0.001	0.000	0.000	0.000	0.000
40	0.547	0.248	0.066	0.012	0.003	0.000	0.000	0.000	0.000	0.000
45	0.542	0.218	0.069	0.018	0.005	0.000	0.000	0.000	0.000	0.000
50	0.565	0.241	0.072	0.016	0.000	0.001	0.000	0.000	0.000	0.000
55	0.528	0.213	0.065	0.009	0.001	0.000	0.000	0.000	0.000	0.000
60	0.541	0.240	0.058	0.016	0.001	0.000	0.000	0.000	0.000	0.000
65	0.542	0.199	0.067	0.014	0.004	0.000	0.000	0.000	0.000	0.000
70	0.541	0.223	0.053	0.012	0.003	0.001	0.000	0.000	0.000	0.000
75	0.546	0.217	0.072	0.018	0.005	0.000	0.000	0.000	0.000	0.000
80	0.595	0.219	0.060	0.020	0.006	0.000	0.000	0.000	0.000	0.000
85	0.546	0.218	0.069	0.014	0.003	0.001	0.000	0.000	0.000	0.000
90	0.559	0.223	0.070	0.017	0.002	0.001	0.002	0.000	0.000	0.000

Table G8. Proportion of Repeated Threshold Determinations for A-NO-2; i.e., first two congruent with no percent rule, no limit on number of ascents, no update.

-10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table G9. Proportion of Repeated Threshold Determinations for H-UP-2; i.e., two congruent out of last four (half rule with updates), no limit on number of ascetns.

	SLOPES									
dB HL	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
-10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table G10. Proportion of Repeated Threshold Determinations for M-UP-2; i.e., two congruent out of last three (majority rule with updates), no limit on number of ascents.

-10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Stopping rules for ascending audiological test procedures were evaluated by Monte Carlo Simulation. The stopping rules differed in the minimum number of correct responses required at a level, whether these responses occurred on half or a majority of the ascents, and whether all or only the most recent ascents were considered. Simulated threshold values ranged from -12 to 92 dB SPL in steps of 1 dB. Slopes of the psychometric functions ranged from 0.1 to 1.0 in steps of 0.1. For each procedure, 200 threshold determinations were

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simulated for each combination of slope and threshold value.

For all procedures, shallow slopes resulted in thresholds closer to the level giving 50% detection than did higher slopes, which were roughly 2.5 dB above 50% on the psychometric function. Shallow slopes also resulted in decreased consistency across threshold measurements, an increased number of trials required for threshold estimates, and a higher proportion of estimates that had to be repeated to obtain threshold. Stopping rules using a two-response criterion were faster than those using a three-response criterion, with only a small decrease in consistency. Among stopping rules using the same number of responses for criterion, differences were seen primarily in efficiency at shallow slopes, particularly for procedures using a three-response rather than a two-response criterion for stopping.